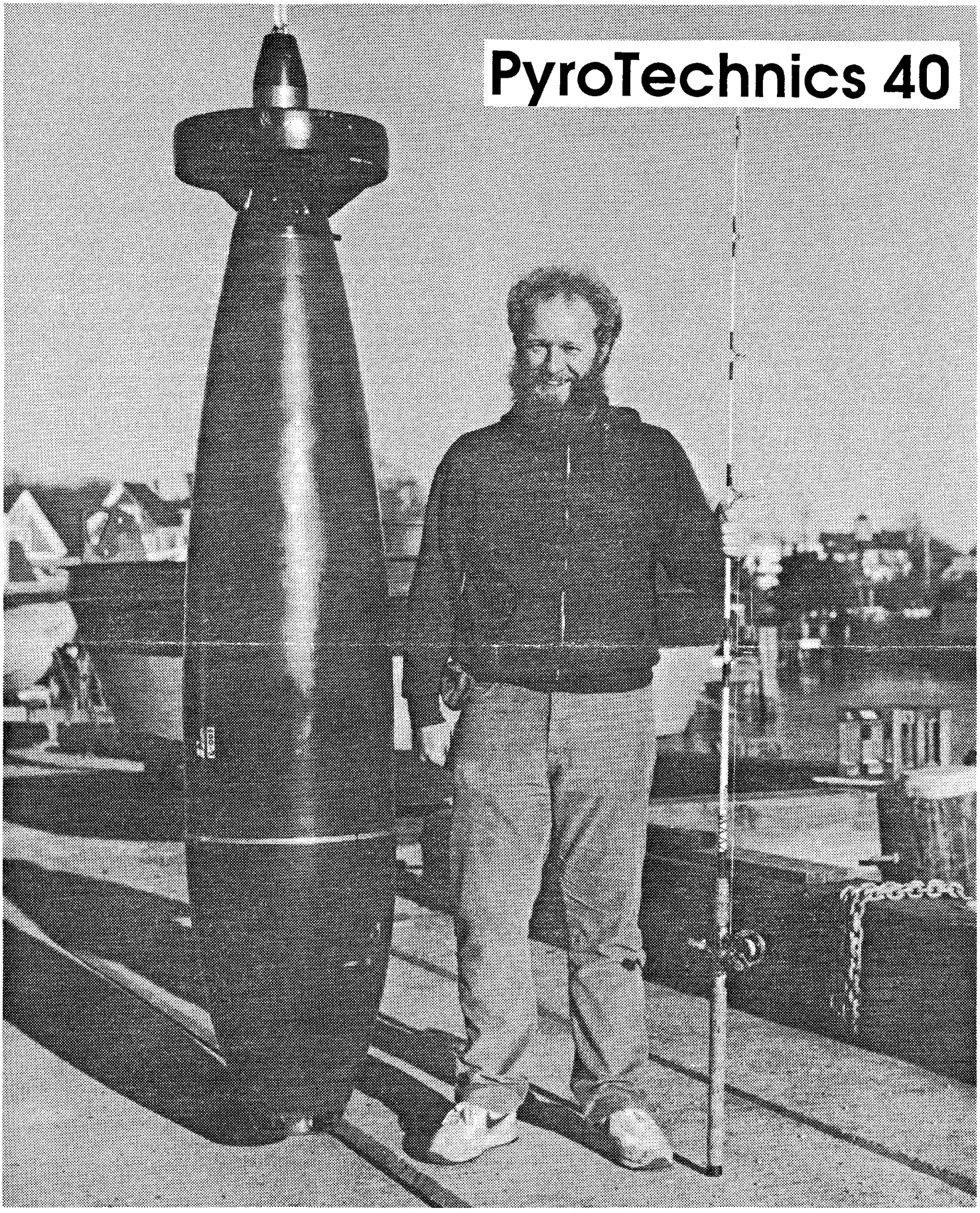
PyroTechnics 40



The Now & Then Newsletter of General Technics

PyroTechnics 40

Department of Free Lunches Revisited

Barry Gehm

Those of you with more talent than money (and that seems pretty common in GT) will be pleased to learn that we have modified our no-freebies policy for contributors. We will now be offering free issues in exchange for articles and artwork. Contributing subscribers will have their subscriptions extended by one issue; non-subscribers will recieve a free copy of the issue in which their work appears. But wait, there's more! You also get the thrill of seeing your words (or art) immortalized in xerox toner, and a genuine United States postage stamp (cancelled) that you can pass on to your grandchildren. How can you resist? Write an article! Draw a cartoon! Send it in today! (Or at least by February 5th, if you want it considered for the next issue.)

Here's the fine print: only contributions that are actually published earn issues. LOCs will not earn issues unless the editors decide to run them as articles because of unusual significance or interest (for instance, David R. Palmer's letter in this issue.) The editors retain the right to determine what constitutes an article, and to accept or reject submissions according to our own mysterious standards. We will not be accepting fanzines in trade. And your free lunch does not include soup, salad, or dessert.

LOC us up. Even though we can't offer free issues for LOCs, we love to get them! Please let us know how we're doing. If we're doing something wrong, we need to know, and if we're doing something right, we need the egoboo. That's all this job pays, friends. And, at the risk of sounding like a high-school newspaper editor (which I was), this is your newsletter. "You" being all members of General Technics (whatever that means) and all you folks who think you might be / could be / should be / usedta be / wanna be. So let us hear from you.

Who's in charge here? Mary Lynn has asked me to point out that, although she is acting as PYRO's mailbox, she is not the editor, and letters to the editors will be routed to the appropriate parties for consideration and reply. Therefore, just because your letter may start out "Dear Mary Lynn" doesn't mean that only she will see it or that she will be the one to answer it, if a reply is needed. I think she'd be happier if some more general salutation were used. ("Dear PYRO-maniacs," perhaps?) The distinction between being an editor and being Chief Dominatrix Whipcracker is subtle, but I'll be happy to explain the workings of the PYRO editorial board to anyone who can pass the simple qualifying exam of drawing a complete organizational chart of the Byzantine empire. Meanwhile, please note that subscription checks should be mailed to Mary Lynn, but should now be made payable to Connie Trembley. And please write "PYROTECHNICS" on the comment line.

Read the label. How do you know when it's time to mail in a subscription check? Look at your mailing label. It should say how many issues you have coming. (If you paid Jamie for a subscription the number will include that credit.) If the number is small you should consider sending in your subscription. If the number is zero, this is the last issue you will receive unless you renew. No kidding.

I should mention that, despite our TANSTAAFL editorial, the last issue was a freebie for everybody. Because it was the first issue under the new management, it was small, and we didn't debit it against the accounts. Being insanely generous, we now follow the freebie with a two-fer. This is a double-size issue. Currently, we plan to do three 10-page issues and one 20-pager each year. All for only 4 bucks! Such a deal!

New and improved. We're kicking off two new features in this issue that I hope will become regulars. **Squibs** is a column of short items "by divers hands": it's intended to provide a place for ideas, anecdotes, and observations that aren't long enough to be individual articles. Anything short and of interest to techies is welcome. I know they're out there: I hear dozens of them at every convention. You don't have to fill up a whole page to participate in PYRO; send 'em in. Our other new feature is **Ask Dr. Techie**, a question-and-answer column. Here's a chance to dive into the great information pool that is General Technics. Send us your questions. We prefer those with a scientific or technological slant, but we'll take what we can get. Put the great minds (cough, cough) of GT to work for you!

Quarks

• In putting together *PyroTechnics 39,* we were discussing our mailing list. Alice Bentley had obtained an IBM disk from Jamie Hanrahan—or was it CP/M?—and wanted to convert it to he Macintosh database. "I'll just take it home," she said, "and run it through some of Mike's software to take the weird characters out and so forth."

"You'd better not!" said Higgins.

"Why not?" asked Alice, astonished.

"As one of the Weird Characters on that disk, I object to being removed!"

• *Police Arrest Werewolf for Biting Women on Neck!* There in the *Weekly World News* was the photo of a werewolf. Standing in the grocery store, Mary Lynn Johnson (our Whipcracker) thought the werewolf looked familiar somehow. She contacted Mark Hyde, special-effects man and former fudge chemist, in California. Was it he? Yup, *WWN* had somehow gotten a photo of Mark in his wolf-alien costume, along with what seems to be an entirely fabricated story. Mary Lynn may not be very good with names, but she never forgets a muzzle.

• Get away from it all. Live on a horse farm. Become a barn manager. That's what Cathy Leddy's doing, outside Redmond, Washington, with her husband Larry Brader. Larry's recovering from military/industrial complex burnout and has started studying graduate mathematical physics at the University of Washington. They're running their own company, too.

• Max Monningh's piece on dry ice in this issue reminds us of the Battle of Jutland. Weather was lousy, and the Germans and British had to contend with fog banks that made it difficult to see their own ships, let alone the the enemy fleet. Some years ago Richard Rostrom was responsible for refereeing a recreation of that 1916 North Sea battle for his Chicago group of naval wargamers. With fifty pounds of dry ice and some shallow trays of warm water, Rich manufactured historically accurate weather to add a bit of realism to his simulation. (Just make sure nobody steps on the dreadnoughts when they're hidden in the fog!)

• Anders Wilson, son of Mary and Rolf, made his first appearance at a Windycon just a couple of weeks after he made his first appearance anywhere. Then Anders attended Chambanacon in his hometown of Champaign, Illinois. If he keeps this up at this rate, he'll have attended 504 science-fiction conventions by his 21st birthday. Meanwhile, in Chicago, Matthew Insley arrived much earlier than expected, and Alan and Judi hardly had time to tidy up the apartment. We suspect they made a pretty good first impression anyway.

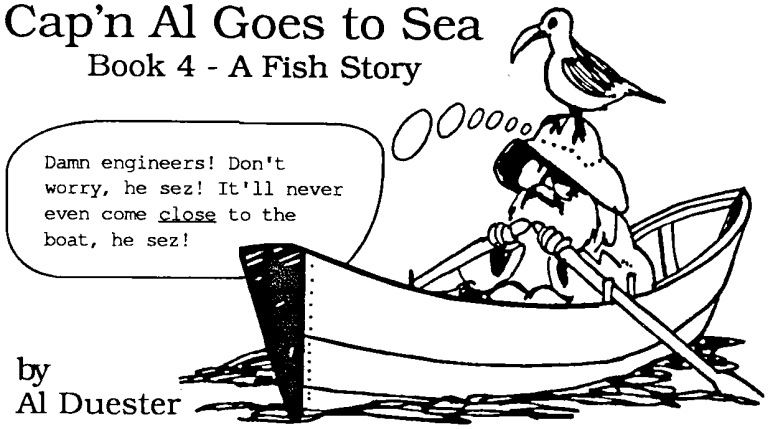
• "Luminosity" is the figure-of-merit that tells you how well your particle storage ring is doing. If Fermilab's Tevatron collider has high luminosity, lots of proton-antiproton collisions are taking place, and the physicists taking experimental data are happy. Consequently everybody watches the luminosity readings carefully. Todd Johnson recently built a box to divide down the frequency of the luminosity signal coming back from the Tevatron's experiment to a slow rate. Then he plugged it into the Main Control Room Christmas tree. For the duration of the holiday season, a glance at the tree's blink rate told visitors the state of the experiment.

• In other news from the Fermilab axis, the lab was a popular spot with SF writers in November as James Hogan, Jack Williamson, and Fred Pohl got tours from various members of the *Pyro* staff... If you're tired of reading about the antics of the people editing this zine, why not let us know what *your* gang is up to?

The fabulous techie cookbook, *Adventures in Thyme and Spice,* is now on the streets. Post-publication price is now $12.00 plus $3.00 for shipping (it'll be delivered by UPS, in a padded mailer). To order a copy, write to its editor, Mary Lynn Johnson, at the *PyroTechnics* address. But if you send a check, make it payable to Mary Lynn, *not* to *PyroTechnics!* All profits on this project go to charities.

Cap'n Al Goes to Sea

Book 4 - A Fish Story



by
Al Duester

((Cap'n Al is an Ocean Engineer at Woods Hole Oceanographic Institution. He designs and builds instrumentation that gets thrown in the ocean and lost with a disturbing frequency. The way he got his nickname has nothing to do with water, thus the title.))

Prologue:

Since it has been so long since I wrote and got the last episode of "Cap'n Al Goes to Sea" published, I've decided to compile several cruises at a time into each of the next few "books". Contrary to what was reported in the editor's note for Book 3, I am not abandoning the series. "Not planning on going to sea in the foreseeable future" somehow got translated into "not writing any more episodes". Since then I've been to sea 6 times. In Book 2, you may recall that we lost a Pop-Up Profiler. We were able to recover it at a later date using the Alvin. I, however, did not get a submarine ride.

This episode deals with the early tests and first real cruise for the Fast Profiler. The last few years I have been working exclusively on the Fast Profiler, or as we call it, The Flying Fish (or Fish, for short). I've kept sections in the diary style which uses the present tense, as the flavor seems to come through better. A good deal of this stuff gets written while I'm at sea (usually when the weather gets too rough for me to play Dark Castle). The adventure continues.....

A Short Glossary:

CTD: An instrument package that measures Conductivity and Temperature versus Depth. Usually lowered on a winch wire in conjunction with a water sampler.

Fantail: The deck area close to the water at the rear of the ship where we launch instruments.

Fish: The Fast Profiler - a fluorescent orange bomb shaped instrument with four fins in a ducted ring type of configuration.

Gyre: The name of the vessel our August 1986 cruise utilized. Also refers to large circular eddy currents in the ocean.

"On Station": A phrase referring to the ship being located at the proper site where experiments are to be done.

PUP: Pop-up Profiler - a tripod lander style instrument we developed a few years ago that remains on the bottom for long periods of time. It releases expendable 15 KHz. acoustic transmitter probes (Whelps) that it tracks. The data yields a profile of the currents in the water column above the instrument.

Richardson Release: A piston which slides into an air filled cylinder is connected to a machined brass bolt. As pressure increases, the pull on the bolt increases till the shear point of the bolt is reached, whereupon the bolt breaks. A very reliable but not very accurate pressure release. The release depth is set with a lathe - oceanography Tullio style!

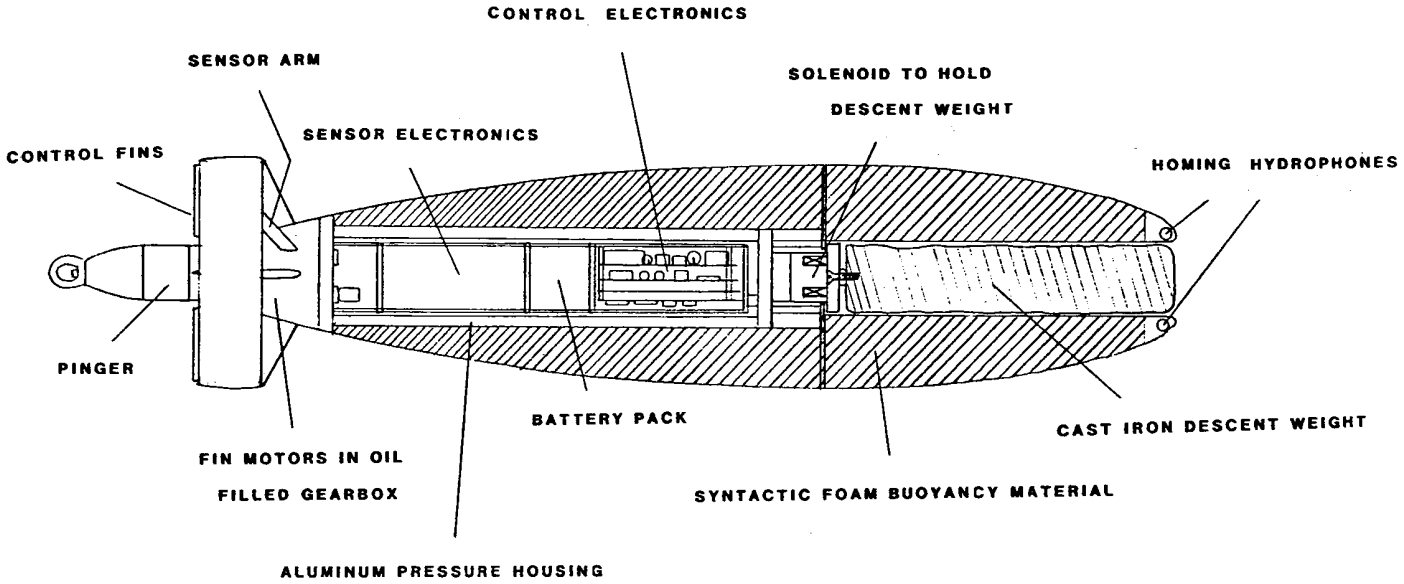
SAIL: Serial ASCII instrumentation loop - a 20 mA. serial current loop and protocol (we even have an IEEE standard). We use it to communicate with instruments because it only uses two wires, reducing the number of penetrations through a pressure case.

Wet Paper Recorder: A device that pushes paper treated with an electrolytic dye out at a slow rate. The recorder has a continuously rotating platen with a helical electrode on it. The electrode presses the paper against a fixed steel rule that is the other electrode. The voltage present across the electrodes determines the amount of dye that appears. With a simple power amplifier and hydrophone you can listen to any instrument that has a fixed repetition rate pinger. With the pinger repeating at the same speed as the platen rotation you can optically integrate incredibly quiet signals in gobs of noise. You can see if you are changing range to that signal by the slope of the line on the printer.

Zodiac: An inflatable but rugged small boat made famous by Cousteau.

The Beast of Which I Speak:

The main body of the Fish is made of syntactic foam - glass microballoons in an epoxy binder. It provides the flotation. It will withstand a great deal of pressure, and unless it has been cast with an embedded air bubble, does usually fail catastrophically, as the large glass spheres sometimes do. The two body sections are drilled so that a 6" diameter pressure case fits in the center of the rear, and a sleeve that fits around the drop weight fits in the nose. An electromagnet on the forward endcap holds the descent weight in place. The descent weight is a 100 lb. chunk of 4" diameter steel or cast iron (whichever is cheaper at the time), with a plate loosely mounted to the end that contacts the electromagnet to eliminate misalignment problems. The rear endcap has several connectors that come out into an oil filled rear gearbox enclosure that is maintained at ambient pressure. The motors, gears, and electronics to drive the fins are mounted in this gearbox. Surprising as it may seem, regular cast epoxy electronic components have few problems operating at 10,000 PSI in oil. The oil also provides a good heat sink. We do this as it is very hard to make a seal that will allow rotation with a pressure differential in the thousands of PSI. The endcap makes up one wall of the enclosure. A cone machined from a nylon-like plastic makes up the remainder of the enclosure. A stainless steel strongback runs up the center and provides for lifting, as well as mounting for the gears and motors. The gearbox is an assembly nightmare that puts Japanese electronics to shame. Just behind the gearbox is a pinger that sends at 10KHz. chirps. The Fish sends a crude telemetry - a digital nybble of four possible chirps every other second. We can tell which of 16 possible modes the Fish is in, including "everything's hunky dory", "I've dropped the weight", and, "I don't know where I'm going so you better be out of the way", among others.



The entire Fish is held together by tension. There is a single combined bolt and sliding valve that Josh designed that, once undone, allows the tail section, rear endcap, and all the electronics to slide out of the rear of the Fish. It's easy to pull the Fish apart to work on the electronics. When the Fish is put back together, the valve lets us pump out the air to seat the O-rings correctly (hear that NASA?) and check for leaks. We can also pump out most of the hydrogen generated by charging the lead-acid batteries through this valve.

The nose of the Fish contains four sensitive hydrophones cast in a special clear plastic. The plastic is clear because there are two strobes also cast in it for night recovery. The hydrophones listen for a 15KHz acoustic beacon that floats on the surface. When everything works, the Fish steers toward the beacon, and is supposed to hop out of the water 50 ft. from the rear of the ship.

The Fish was the doctoral thesis project of Josh Hoyt, and he had been working on it for a year or so with Al Bradley as his advisor before I got involved. The project goes well beyond his thesis, as the World Ocean Circulation Experiment, planned for a few years from now, will require massive amounts of data. It normally takes a standard CTD lowered on a winch wire four hours to get a profile. The Fish can get that same profile in 45 minutes. Your data is less smeared by changes in the water column during the shorter time. More important, we will be able to get either much more data for the same money, or the same amount of data for a lot less money. Time is money, as it is said, and our cheapest full-ocean-capable ship costs about $7K a day to operate! Now that Josh has graduated, Al and I are continuing the development of the Fish.

Flashback - Spring 1986:

The Asterias is a small vessel we use for work close to shore. During the past year while we were developing the Fish, we made two trips out on Asterias to a deep hole (200M) in Georges Bank about 20 miles north-east of the tip of Cape Cod. Several times we had to delay the cruise for a day because of things acting up, or rather, not acting at all. Once frost had caused a problem with the nosepiece. Another time we had crimped a wire when bolting the two sections of the Fish body together.

On the first drop the Fish went down, and when it surfaced it was nowhere near the acoustic beacon it was supposed to home in on. As the Fish leaps its own length clear of the water and weighs 350 lb. out of the water, this concerned the captain of the boat, which has a wood & fiberglass hull. We had foreseen this, and had kept the boat well outside of the range that we calculated the Fish could possibly come up in, but that didn't seem to make the captain any less nervous. We were running the homing beacon out on the end of a 250 ft. floating tether/power cable. After a few more test drops we determined that the Fish was not able to turn around and stabilize in a water depth of only 200 m.. It was back to the lab for some work on a temporary system that would allow us to deploy the Fish backwards so it would already be pointing upward when it began its ascent.

The second trip out was a strange mixture of success and failure. Josh had developed a dual weight release made from window sash weights. When the lighter weight touched bottom, it released pressure on a lever that held a heavy weight, dropping it. The lever would be pulled back and free swing so as to release the light weight when the Fish started rising. Both weights were on lines so that when they released, the Fish would be far enough off the bottom that it would be able to slow and start upward without getting its tail stuck in the mud. Now all we had to do was get the Fish into the water with the end that the Fish is lifted by aimed downward so the weights and release didn't fall off!

The shape of the Fish is unstable travelling backwards - it whips wildly back and forth when towed in reverse. This would cause the little release mechanism to prematurely drop the weights. To prevent this from happening we made a 2 ft. diameter plywood washer that fit behind the fins to act as a flow disturber. It was quite effective. We left the next day on another 30 hour trip. The weather was not quite as good as the first trip, and we ended up feeding the marine life a few times once we got on station.

When the fish is in the water, it floats with the nose pointed about 15° above horizontal. We got the Fish into the water the normal way, and then spent ten minutes leaning over the edge hooking the weights onto the tail release, losing one in the process. Using a few extra

lines we managed to lower the weights down to the end of their attachment lines. A quick release of three separate lines at the same time, and the Fish headed (or is that tailed?) down toward the bottom. It was then another mad scramble to get the homing beacon over the side and pay out the power cable, while getting the boat far enough away so that we didn't have to think about lifeboats, survival suits, and the like. Moments later the telemetry showed the Fish had released, locked on to the beacon's signal, and was 30 seconds from surfacing.

Then we saw it leaping clear of the water, less than a foot from the homing beacon! We watched as it arced over and fell tail first on top of the beacon, where we had not put any cushioning foam! We turned off the beacon, hauled it in, and headed over to recover the Fish. Twenty feet from the Fish Josh started spouting four letter words - part of the tail of the Fish had broken off when it came down on the beacon. Silicone oil was pouring out of the tail section where the fin drive motors and their "at pressure" driver electronics are . Seawater, nice conductive seawater, was pouring in.

The fin drive motors are connected directly to the main power bus. If the water were to cause enough of a short to blow the fuses in the system, or the batteries run down because of the load, the memory containing the data for Josh's thesis would go dead. But the lifting eye that was mounted on the tail had gone to the bottom, and the fins could not support the weight of the Fish to lift it. The problem now was getting the Fish onboard fast, getting out the water, and then getting out the data. Thinking fast, I unlashed the transport & disassembly cradle for the Fish and started whipping lines around the forward sliding part to bind it to the rest of the cradle. The captain popped open the main engine hatch to search among the tools for an auger bit to drill four holes to function as lift points. Josh was hanging over the fantail holding the Fish, trying to keep it from hitting the ship. It took a few minutes to drill the holes, and then knot some lines together in a crude four-pint lift harness. Josh was very wet at this point. Quickly hooking the cradle to the winch wire we got the cradle into the water and manhandled it under the slippery, oil coated Fish, trying to keep our hands from getting crushed between it and the ship. Then we lifted it out, got a bucket under the Fish's tail, and emptied out the oil and water mixture. While we were doing this, Al was tripping past piles of line and tools getting the power and SAIL umbilical ready to slam in place. He got it attached before the Fish hit the deck, and he and Josh were in at the Mac trying to get what they could, as fast as they could. Minutes later Josh was on the deck grinning. He got all his data, the trajectories were great, and he would be able to graduate. He smiled as he said "It's your problem now!".

R/V Gyre Cruise, August 1986:

A few things have been modified since the Asterias cruises months ago. We put conformal coating on the motor driver boards to reduce the chance of shorting from minor leakage of seawater into the tail section. With all the connectors that are there, there's no way to save things from a massive leak like we had. We can try to minimize damage from minor catastrophes. We've strengthened the tail section as much as possible, but without more time to redesign the tail section we will just have to be careful. Instead of picking the Fish up from a stowed position where it is lying on its side, we've built a tip cradle so the Fish gets tilted to vertical before it is lifted. That way the strongback in the tail doesn't have to resist the horizontal, only the vertical pull. I've rebuilt the homing beacon, reducing its size and mass, and enclosing it on all sides with foam. Since we're sending the fish to greater depths, the ship will have to be farther away. The length of cable needed isn't practical, so I've designed a battery buoy that is two inches in diameter and six feet tall. The battery buoy will be on a 30 ft. cable to keep it away from the acoustic beacon the Fish is aiming at. It also has a small enough cross section that the Fish should not be able to accidentally hit it.

I break my foot playing softball two weeks before the cruise is supposed to leave. Coming in on a run, there was a bit of dirt on the plate, my foot twisted just the slightest amount extra, and I heard a snapping noise. The Ocean Engineering softball team is pissed, because I broke my foot playing for another team. I misread the schedule and showed up on the wrong day. Since one of the teams there needed players, I played.

The intern in the Emergency Room tells me it's a broken toe and sends me home with an elastic sock on my foot. It just so happens that our concertina player in the Woods Hole Folk Orchestra is a podiatrist. A few days later while asking about some music I find out that the metatarsel that's fractured is part of the foot, not the toe. It's more serious than the intern in the ER made it out to be. He puts a soft cast on it at 10:30 in the evening, at WHOI. I buy the beer for the "house call". Work is easier to deal with than home, as the linoleum floors and wide hallways are easy to scoot around on my chair - at home I end up tripping myself several times an hour on all the junk. The floor resounds with clattering from my casters as I race from one end of the hall to the other, zipping by startled pedestrians emerging from the Xerox room. With all the trips I have to make between the hacker's machine shop and my office, I wonder if I'm going to wear out the chair. At home I move the mattress downstairs to sleep in the living room so I don't have to navigate the stairs. The cat decides to join me, and perches on the windowsill. It falls asleep, and then falls off, right...onto...my... foot... The cat finds out

in a hurry that isn't a good thing to do and takes to sleeping in the window at the top of the stairs (so it falls out of that and down the stairs several times a night just waking me up). A week before the cruise I get a fiberglass walking cast put on.

We've been madly working for the past few weeks trying to get a Fish and two Pop-up Profilers (PUPs-see book 2 for info on them) ready for the cruise. I've been tuning and assembling the PUP's expendable acoustic beacons (Whelps) with the assistance of a technician. One Whelp from an earlier cruise has a problem, so it has to be disassembled and repaired. The tech disassembles the probe (with a bandsaw), and later in the evening I sit down to repair it . I bump it while setting up, and the battery pack shorts out. A "C" cell ruptures and spews steaming alkali over the front of my power supply. At least it wasn't my face. Three days before leaving, the Principal Investigator for the PUP project decides that we would be better off deploying it off Cape Hatteras in November, to do some real science (real sick is more like it). Since I've spent the better part of the last two weeks on PUP rather than Fish stuff, I'm a trifle pissed. Now we can concentrate on the Fish, with hopes of actually getting it to perform.

This trip we have a group from a local company going out with us. They have been developing a new high speed CTD for use on the Fish and other vehicles. This cruise will be the first real ocean test of the unit. They showed up early enough to ensure that the unit actually fits in the Fish, and then left.

The past few days have seen me only going home to sleep. Working till 2 AM on battery packs, high voltage electronics, tuning up spare receivers, and building acoustic beacons has left me drained mentally. For relaxation, I spend some time slicing up flashlights on the bandsaw and epoxying the heads onto my hardhat for use in night recovery operations. Whoever goes out in a Zodiac to recover the Fish is going to need both hands to grab it, and won't have a third to hold a flashlight.

Tuesday - Cruise Day:

The 10 AM departure time comes and goes, and we're still not ready to leave. Overnight the Fish developed a leak in its tail section, and a cup or so of silicone oil has dribbled out onto the floor. While Albert and a few techs start the time-consuming task of gearbox disassembly to find out what is wrong, I decide to take the time to travel in comfort - I have one of the carpenters drill holes in a sheet of plywood for the casters of my office chair, then mount the sheet on 4x4's for extra height.

I've spent the entire afternoon in the shipboard van, nailing down and tying up our equipment so none of our lovable Macs tries to leap out and give us a peck on the cheek. When the time comes to finally leave, I'm surprised at the number of folks that show up on the dock to see us off. A deckhand had passed a spliced loop around the cleats on both the ship and dock at high tide. Now that the tide has gone out, the loop is tight, and can't be freed. The line has to be cut with a handy fire axe to free the ship.

The cook prepares the best steak I've had for five years for dinner. One of our techs made a batch of cupcakes, and I brought a box of cheese danish. There is a freezer in the messroom full of ice cream bars, cups, and sandwiches. I'm almost hoping for some horrid weather so that I won't be tempted to eat myself into a coma. It's the evening of our first day out at sea, and already my boss has begun to resort to torture to get us to keep working. He's on the fantail playing his bagpipes.

Wednesday:

This afternoon I finished building the catylator for the battery buoy. The catylator uses palladium pellets to react the hydrogen and oxygen released when the batteries are charged, so we don't end up with an explosive atmosphere inside the casing. Dessicant absorbs the water produced. Testing the homing beacon on the new higher voltage battery pack (45V) blew the fuses. Dummy me forgot to increase the voltage of the protection zeners in the beacon after increasing the voltage of the battery pack. One shorted out, blowing fuses. Of course, we don't have zeners with a high enough voltage, and can't seem to find the local Radio Shack, so I cobble together two in series. After another few hours putting everything back in working order, I drag it all out on the fantail to see if the battery buoyfloats - it does. At least I don't have to figure out where to get more foam.

Thursday:

We prep and drop the Fish on its first dive this cruise, and deepest dive to date, to a kilometer. The weight has a Richardson release on it just in case the rest of the release fails. Because of this, the weight sticks an extra three inches out of the nose. The Fish goes down, and even comes back. It fails to home in on the beacon very well - it pops out of the water 50 ft. or so away. JT and Stan hop into the Zodiac and head over to retrieve it. They notice that it's not pinging when they get there, and the xenon strobes are dark. Oil is slowly leaking from the tail section. When we get it on board we find both main fuses blown, so there's no dive data left. The pressure compensation bladder's transfer tube had pinched shut, and the difference in compressibility between oil and seawater had forced the water into the tail enclosure. The compensation bladder is a short crimped section of bicycle inner tube that provides a reservoir of extra oil that flows into the grabox as the oil compresses as the Fish gets deeper. In early tests Josh had tried using condoms, but the silicone oil tended to dissolve all the brands he tested... We think there may have also been a few air bubbles in the enclosure, but the compensation bladder was supposed to.., well.., compensate! The O-ring seals in this section were not meant to withstand pressure, just keep the water out, and they hadn't! One of the rings had extruded into the enclosure. A big short (say what?) had blown both fuses, after doing some nasty corrosion damage. There was no problem until the Fish surfaced and came to rest horizontally, and then the water crept into place and shorted things out. We rip everything apart, and go well into the wee hours cleaning and rebuilding it using all our spare motor driver boards.

Friday:

Since the Fish has never appeared to home very well, I make a worst case assumption that the cargo netting holding the pieces of the homing beacon together could have been blocking or distorting the acoustic path out through the bottom. I replace the lower rope retainer ring and associated wuzzle with a larger double line of parachute cord so there is a clear path out the bottom.

We do another drop of the Fish. The Fish comes out of the water several hundred feet from the acoustic target. So much for my idea for an easy fix. Plotting the accelerometer data shows the Fish veering wildly from side to side, overcompensating so much that the receivers lose tracking of the signal. The Gyro data shows the Fish twisting sharply as well. It is now apparent that the Fish never stabilizes enough after the turnaround transient for the receivers to lock onto the acoustic signal. There are two periods of three seconds each in the data where the receivers locked on, but the Fish was unable to overcome its turning momentum fast enough to get the receivers to stay locked. We change a few values in the control algorithms for the next try.

The Captain didn't seem too thrilled with my "Going to Sea is like going to jail with the added risk of drowning" T-shirt..... Fried shrimp for dinner tonight. This ship is from Texas. Care to guess how much I ate?

I'm trying to convert from MBASIC interpreter to ZBasic to gain speed in our data plotting program. After spending a few days converting it, I discover that ZBasic just cannot perform some of the very simple but necessary functions. Working in this van by myself, with a computer and coffee under the fluorescent lights, it feels like well into the morning hours. It's only 7PM.

We decide to go for a second drop before dark. We really haven't thoroughly tested the static characteristics of the Fish's body in ascent mode - we aren't sure of how its really acts if it tries to go straight. As a control experiment, we drop it with the motor drivers for the control fins disconnected. The wet paper recorder shows a wavering trace, and we assume the Fish is weaving to and fro on the way up. Later in the evening as we examine the data we see that the Fish's accelerometer and gyro readings hardly change. The motion of the plot on the wet paper recorder is due to wave, ship, and hydrophone motion, not that of the Fish.

I was busy taking 8mm movies of the launching of the Fish. By the time I got to the beacon launch position on the fantail, the ship had already started moving, and I was very rushed (trying to move fast in this cast, remember). I threw in the beacon, got the battery buoy on the other side of the safety line, and had the battery buoy yanked out of my hands before I could plug it in! Since I blew it, there was no information to give us any clues about the receiver's performance, without the control system madly pitching and yawing the Fish. We toss in the beacon first is because it is loud enough to cause at least pain, if not damage.

Saturday:

Today we went back to Nantucket to drop off a crew member who had a death in the family. We couldn't bring the ship into Nantucket harbor because of the depth. Another smaller ship came out to pick up the crew member. Once that was done, we headed south, as we would get to deep enough water for our next tests sooner than heading back north-west toward our original location.

Since we were in transit with not enough depth to deploy the Fish,, and I had given up on ZBasic, I had nothing to do. I watched three movies in a row on the VCR. Do you remember that in 2010, in the scene where David Bowman's mother is in the intensive care ward, and the nurse outside is reading a copy of Time magazine? Well, the magazine cover has WAR?" in large red letters splashed across the top, in regard to the South American situation that has developed in the movie. There are paintings of the (presumably) American and Soviet leaders - the one on the left seems to be Arthur C. Clarke. I'm not sure who is on the right.

The other members of the research team are busy installing their CTD into the Fish, while Al has burned a new set of PROMs. We can now select between no motor action at all through the dive, or waiting for 30 seconds after the Fish drops the weight and heads back for the surface to engage the motor drives. The receivers will have been running and probably locked on to the signal before the motors are activated. Hopefully this last action will eliminate problems with the turnaround transient.

Sunday:

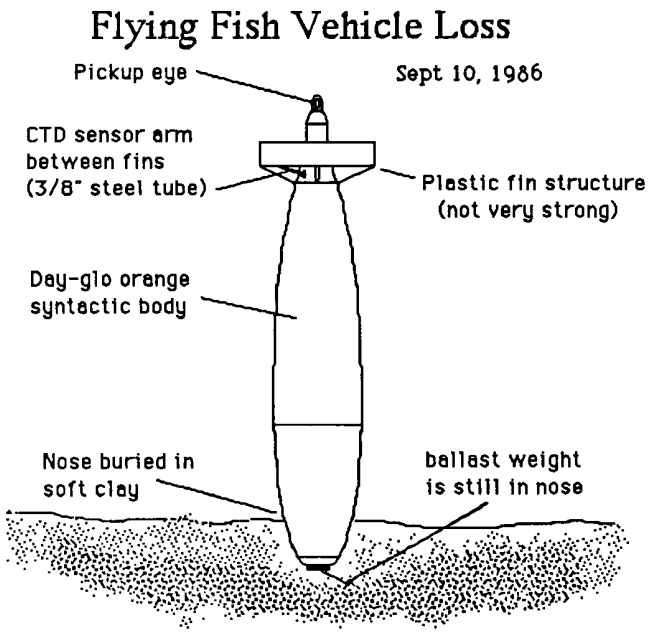
I didn't sleep very well last night. The combination of caffeine and seeing well over two hundred people shot, drowned, blown to pieces, eaten by crocodiles, etc. on the videotapes has left me very disturbed in regards to the directions of tastes of the American public. I suppose I could have gotten by without watching that James Bond tape.

As we prepare to launch the Fish, a squall approaches and we abort the dive. After waiting an hour for the squall to blow over, we launch the Fish, this time with the CTD installed. Once again, the Fish misses the target by at least 50 feet. We let the CTD folks strip and start processing their data, then reset the main processor and strip ours. We get all our data plotted on the Mac before the first CTD data plot even starts coming out of their IBM. The data shows that the Fish's control system is not stable.

The Concord is an incredible sight seen going overhead. It lays down a vapor trail at an amazing speed. We had one fly over fairly low, coming out of New York. It was past us by about 45° from vertical when the twin sonic booms hit us. The volume never fails to amaze me - just thinking about the amount of energy that the plane expends acoustically.

The fifth time we launch it, the Fish again misses the target by about a hundred feet. Now the CTD data has some strange quirks in it, so the CTD folks are spending time trying to figure out their instrument's response. The weather has picked up enough that the Zodiac crew is getting wet. As Stan remarked, the Zodiac work was "a piece of cake - a regular Dunkin' Hinds". The deck of the ship is occasionally awash now as well, and the mixture of water and leaking hydraulic oil from the crane is making the deck dangerously slippery.

I make an amusing sight lumbering around on deck. Bright blue shorts, with bright red sunburned legs, and one leg wrapped in three layers of plastic bags to keep the mixture of seawater and hydraulic oil leaking from the crane out. Staying upright on two good legs is hard enough when a wave takes the ship, so I have been practicing "controlled careening", bouncing off the side of the van towards the winch and then to the hatch. I've discovered that if I crawl out the back door of the deck van (which only opens part way), I can reach across to a ladder and climb it to the 01 deck. That leads to the lounge and my cabin, and it saves 50 feet of walking.



More important, I don't have to either dodge waves or suit up my foot to get to the van.

We've been dropping the gain on the motor driver system and we're now at the lowest gain setting still above zero. We may have to physically change the size of the control fins to get the system to home on the beacon.

Dive six came off as poorly as the earlier ones, with the disadvantage of higher seas. The Zodiac is getting harder to deploy and recover. The deck is getting rinsed clean of the hydraulic oil, but three inches of water presents a different set of problems.

Monday:

The day started out bad enough. They woke me up at 6:15 in the morning to do another launch of the Fish. I wouldn't have minded so much but I'd been expecting to sleep late, and I wouldn't have stayed up till 2 A.M. finishing the Ringworld Engineers if I'd known.

After reducing the amount of blood in my coffeestream, I bundle up the foot and head out to the fantail to join the assembling launch crew. Prep and drop were real smooth - we were finally getting the procedure down. The Fish never came back up. At its preassigned depth it started sending back its acoustic telemetry telling us it had released the drop weight, but our tracking showed that it kept on heading for the bottom. We didn't know what happened. Had both the power cut-off circuits for the electromagnet shorted and failed? Were we misinterpreting the tracking data? We hung around the site for the rest of the day, listening to the pinger on the Fish getting quieter and quieter. We took a box core sample of the bottom to see what kind of bottom surface the Fish had crashed into. It turned out to be a very clinging clay, not the sandy bottom reports had said we would encounter in the general area (yes, we had tried to be in an area where the Fish wouldn't get glued to the bottom). Meanwhile there's a John Wayne movie marathon going on in the lounge - or perhaps they're just watching the same tape over and over. We had a depressing turkey dinner. It became apparent after a few hours that the electromagnet's cut-offs were not shorted. In last ditch emergency recovery method, a shorted electromagnet will pull the batteries down to zero in about three hours, causing the weight to release. About six in the evening the Fish gave a last gasp, then went silent. We stuck around about another hour, then headed home after darkness fell. If it had somehow surfaced during the night we never would have seen it. If you've ever tried to find anything out on the endless blue, you'll know what a hopeless task it would have been to try and look for it the next day. We didn't have that day, as we had to get back to port. We stuck around about an hour, then headed home. We laughed, we cried, we kissed $200,000 bucks goodbye....

Epilogue:

The failure turned out to be related to a safety measure that Al had redone in the last reassembly of the Fish. A good electromagnetic circuit where the surfaces of the magnet and the plate are clean and there is very little air, or "gap", between them has a certain amount of residual magnetic energy. This energy takes a certain amount of time to dissipate. In our case it would take tens of seconds, and this would release the weight after the Fish had hit bottom. A rough analogy to a flywheel would have a good bearing letting the flywheel spin for a long time. In our case, we had to degrade the magnetic circuit to ensure the weight would release quickly (just enough sand in the flywheel's bearings). We did this by putting a very thin layer of mylar tape on the end of the electromagnet. This would drain the energy out quickly, but not reduce the electromagnet's maximum holding power below the required holding power. With all the activity, the mylar tape had worn and shredded, and we couldn't keep enough pull on the weight. Unfortunately, we did not pack any of that mylar tape, and so we grabbed what we could - thin vinyl electrical tape. If you've ever looked at the surface of vinyl tape, you'll see that it is uneven and lumpy. When the magnet was turned on, and the polished steel striker plate of the drop weight was pulled against the tape, it formed dozens of tiny air pockets, each with its own vinyl O-ring seal. When the whole system was at depth at thousands of PSI, those air pockets provided enough force to hold the drop weight to the magnet. The result is that the Fish rammed nose first into the clay at 7 meters/sec, further plugging things up, possibly breaking and jamming the nose around the weight. If it ever released, it would make its way towards Great Britain on the Gulf Stream.

Several months later, Al was able to get a dive on the Alvin as it was returning Woods Hole. The underwater directional sonar system on Alvin crapped out halfway through the dive, so they weren't able to complete the search pattern. However, as they were able to find several beer cans at 100 meters with the sonar, it is unlikely that the Fish was in the area. It's still speculation as to whether it's down there or floating about somewhere. We were able to duplicate the taping problem in the pressure test facility here. But in ten trials, the longest time the weight stayed attached was about ten minutes.

Cold Smoke

Max Monningh

Often my friends ask me,"Max, what is dry ice? What can we do with it? Where can we get it?" Over the years, I've been asked these questions innumerable times, so I thought I'd answer them once and for all.

Dry ice is solid carbon dioxide, CO_2. Unlike regular water ice, dry ice does not become liquid when it warms up; it goes directly to the gaseous state. This process is called sublimation.

Going from a solid straight to a gas can be very useful. If you are going to take a long trip, and don't want to be bothered with the mess of melted ice in your cooler, dry ice offers a solution. Dry ice offers a way to chill things much quicker than water ice, because of its very low temperature, indeed, beverages and sandwiches will freeze, if you're not careful. Deer hunters like to use it for this reason. Direct contact with meat will result in near-instant freezer burn, so if you want to put Bambi's mom on dry ice, use freezer paper.

The most familiar use for dry ice is fog making. Many remember this from rock concerts, laser shows or their high school and dorm dances. The process is simple: take a tub of water and add dry ice.

If you want to make a lot of fog, maximize the surface area of the dry ice. Break it into little pieces, because as we all know, this increases the surface to volume ratio of the dry ice. Of course, this means you won't make fog for as long, but you will get a higher fog production rate. The prospective atmospheric techie will also be concerned about the surface area of the water...more is better. I personally recommend hotel atrium fountains. Take your bag of little pieces and toss it into the hotel fountain. The lobby will fill with fog. Make it a surprise-- hotels love surprises.

After you make your fog, use it to make laser beams visible. Put a crystal in the middle of the fog and and zap it with your 5mW HeNe. The results are pleasing. Thank you for observing all laser-safety precautions.

Drop a piece of dry ice into your drink, but only if you're drinking a carbonated beverage. "Why?" you ask. The answer is simple: when dry ice evaporates, the CO_2 combines with water to form a weak acid called carbonic acid. Carbonic acid is what makes fresh Coca-cola taste good, and flat Coke taste like IHOP syrup. It will enhance a carbonated beverage nicely (or any other acidic drink for that matter-- O.J. works great), but other drinks don't fare as well. Put dry ice in milk to see what I mean. Don't use a pewter mug either...same reason, except that the awful taste is a toxic metal salt.

After you've made fog and witches' brew with your dry ice, turn to other areas: sports and violence. Dry ice slides on linoleum like a hockey puck. See if you can make a gas bearing out of a piece and use it to slide objects around as if by magic.

Now you want to know about the violence, don't you? Good. Get some plastic soda bottles, the one and two liter kind. Don't bother with milk bottles. Take some dry ice and stuff it in the bottle but don't cap it. Yes, you need the cap. Find a **safe** place to do this: one where you can put lots of distance between you and the bottle, and where you can keep innocent bystanders away. Unless,of course, you want to end up in court with a 10 megabuck lawsuit against you for "mental anguish" from scaring someone. Or putting an eye out. Have you found a safe place yet? Great, get some water, pour it into the bottle and cap it tightly, then get away from the area.

In a few minutes you'll get a satisfying explosion as the dry ice pressurizes the plastic bottle to the point of failure. If anyone wants to know what you're doing, tell them you work for NBC and are researching ideas for next month's episode of MacGyver.

By now you are probably wondering where you can get some dry ice of your own. If you only want a little, try an ice cream parlor. They usually have some, but call first-- sometimes the salespeople (uninformed high school students) don't know if they can sell dry ice sans ice cream. Since dry ice is produced by an industrial process, it can occasionally contain oil impurities. Be sure to check for this if you intend to put it in a drinks. Baskin-Robbins tends to carry clean dry ice. For large quantities, look in your yellow pages under "Dry Ice". In Chicago, dry ice can be purchased from one wholesaler for ten dollars, fifty pounds

minimum. You can certainly think of a use for fifty pounds of dry ice.

If you're going to play with dry ice, some words of caution are worthy. Dry ice is not a toy. It is cold, darn cold. It will cause frostbite within seconds if it contacts bare skin. You don't want to know what it will do to your eyes or mucus membranes. So **WEAR GLASSES, GLOVES, AND COVER EXPOSED SKIN.** Failure to do so could result in a trip to the emergency room.

This cannot be overemphasized: dry ice is dangerously cold.

Dry ice is also an "oxygen deficiency hazard" in enclosed spaces; it can displace oxygen in the air. This is only a problem in enclosed spaces, such as poorly ventilated basements, cars, closets, hotel bathrooms, etc. The CO_2 from dry ice will tend to collect in low lying areas, e.g. close to the floor and in the basement (even if you're using it upstairs).

Fortunately, one can generally sense a buildup of CO_2. Hold your breath for the next ninety seconds to see what I mean.

Don't store your dry ice in an airtight container; it might explode.

If you want to make a smoking fountain, don't even try if it contains real plants or fish. The carbonic acid produced will kill them.

These precautions aren't meant to discourage you from enjoying the limitless fun which dry ice can be; they are just meant to advise care. Dry ice can give you hours of enjoyment: at work, at home, around the campfire, or even during your next airplane ride you can expect to garner the attention and admiration of your friends, who will surely say, "There goes one witty, avant garde person. Where can we get dry ice of our own?"

Squibs

squib \skwib\ *n* 1: a small firecracker ... 2: a brief witty writing or speech.
[In other words, a small piece of pyrotechnics, or a small piece of PYROTECHNICS.]

You Are Here
Neil Rest

I was at the only party I was able to find in New Orleans which *really* didn't close. (Some people from around Baltimore, I think. Anyway, Gary Barnhard was there.) Near the door, on the narrow bit of wall between the door to the john and the room itself, was a hand-drawn schematic, filling an $8\frac{1}{2} \times 11$ page.

It occurred to me to write "YOU ARE HERE" across the top, with an arrow pointing down into the middle. I began to hunt for a marker to borrow. Some guy with a belt of pouches, who wasn't far from where I started, had one, a nice big red one. As I reached for the drawing with his borrowed marker, he said, "What are you doing to my schematic?!!?" [oops!]

I explained. He said he could have a xerox, but that was his copy of the schematic of the electronic door locks on the rooms! I said, "Then you really *are* here!" I don't know if he got the joke... it was late both in the con and the day.

Then he explained to me how the locks work:

(Close examination of the key-card shows that one line down the middle is entirely punched: registration. It turns out that the holes have the size and spacing (at least at that hotel) of old UNIVAC punch cards. All of which has no direct bearing on the theory, but has a lot to do with multiplying a key...)

They are not connected to the front desk, or anything else. There are four registers and a pseudo-random number generator. The four are Master, Maid's, Current, and Next. When a card with the combination of Next is inserted, Next is shifted to Current, and the random number generator produces a new Next. Downstairs at the desk, the master puncher has the seed and the Currents for all the rooms. When you check in, you are punched a card with your room's Next.

This has at least two practical consequences. First, a "key" is good until the next person to get the room actually enters the room. Also (not my own idea—he explained it to me), if you are in your room as a single, and lose your card, the desk may just punch you Next, for safety. So if you haven't really lost your key, and they punch Next, and you don't use it then when the next person checks in and gets the $Next_2$, it won't work, and the hotel will be messed up...

Nucular Devastation
Bill Higgins

All right, let's talk about pet peeves. Mine: "Nucular."

Not misspelling. Nobody spells it that way. Pronunciation.

"Nuclear." It's supposed to sound like this: *noo-klee-ur.*

But an *awful lot* of people say it like this: *nook-yoo-lur.*

I used to think this was a sign of ignorance or poor education. But it isn't. I've heard some physicists and chemists say it that way. Even one weapons guy from Livermore. It shocked me.

Once you become aware of this problem, you hear it *everywhere.* Radio. TV. Bus stops. Parties. Andy Cohen said it best. "It's just like hearing fingernails dragging across a blackboard."

In high school it was agony. Mr. Nohe said it wrong. He taught American Foreign Policy Since World War II. Which, of course, revolved around nucular weapons and nucular strategy and the nucular arms race. I gritted my teeth. Suffered through the semester somehow.

You stop people. Try to correct them. That's when you find that they're not dumb or ignorant. *They actually can't hear the difference.* They don't realize they're pronouncing "nuclear" the wrong way.

Some are willing to change their pronunciation. Nobody ever pointed it out to them before.

If nobody does anything, the problem will persist. Probably get worse.

So next time you hear "nuQlar," stop and point it out. Or call the TV station. Be polite. Any dictionary will back you up. "NuKLEEar."

Maybe together we can turn this thing around.

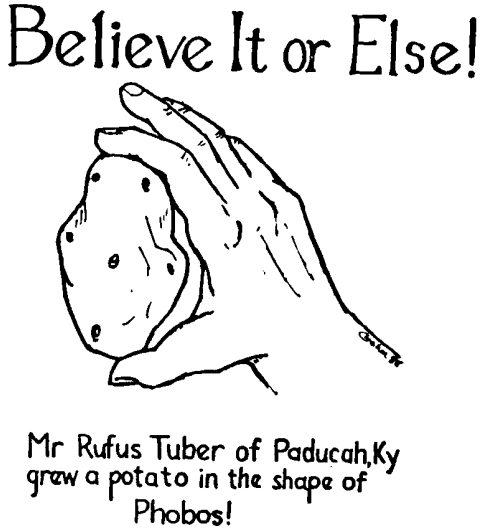
[From Sam Paris] About three years ago, I got a job at Ircon Inc., designing infrared temperature measuring equipment. One of the tools I inherited from my predecessor was a slide rule, a real monster, 18" long and 3" wide with eighteen scales.

I use it 2 or 3 times a week.

Wait, before you start taking up a collection to buy me a calculator, let me explain. I have a calculator (nice one, HP 11) and a PC-AT with all kinds of fancy number crunching software. I use these a lot, more often than I use the slide rule. So why use the slipstick at all? Well, this is a very special slide rule. It was developed during WWII for infrared designers and tells you how much IR radiation you get for a given temperature and spectral region. I can get a quick go/no-go answer to a lot of design questions in less time than it takes for the computer to boot up. So you see the slide rule is still a very useful tool.

Now the guy in charge of engineering computing at Ircon, Steve, doesn't see things this way. Unfortunately, he only seems to come in my office when I am using the slide rule. The first time Steve did this he looked at me, looked at the slide rule, looked at my computer, shook his head, and walked out muttering something under his breath...

[From Barry Gehm] Does anybody buy ordinary carbon-zinc flashlight batteries anymore? The advertising for Duracell, Kodak and company seems to imply that you might as well dip a couple of wires into a cup of warm spit as use anything less than an alkaline cell. I suspect that carbon-zincs are mostly bought by parents whose children have annoying battery- operated toys and by older folks who consider alkalines too new-fangled. I don't know if it's possible to become nostalgic for plain old batteries, but the Eveready company must think so. They're now selling their standard carbon-zincs under the name "Eveready Classic." What's next -- "Lite Batteries"?



Emergence in Doubt: The Palmer-Gehm Letters

Editor's Note: *David R. Palmer, author of* Emergence *and* Threshold, *wrote to take exception to Barry Gehm's review of* Emergence *in* PyroTechnics 37. *In the interest of clarity, we've decided to reprint the original review here. Mr. Palmer's remarks are followed by Dr. Gehm's response to them.*

EMERGENCE by David R. Palmer
reviewed by Barry Gehm

Having surreptitiously sprayed the United States [1] with a genetically engineered microbe, the Soviet Union [1-A] explodes some "tuned" nukes in the upper atmosphere, producing a burst of radiation that selectively mutates the previously innocuous micro-organism into a virulent pathogen, which then proceeds to wipe out virtually the entire human population of the planet.

Candidia Smith-Foster emerges from her bomb shelter [2] to discover that she and a few thousand other people (scattered thinly over the continent) have survived because they are members of a new species, designated Homo post hominem, that has a natural immunity to all infectious diseases, as well as superhuman strength [3], intelligence, senses and reflexes. This species was apparently created via genetic rearrangement caused by the great influenza pandemic of 1918-19.

Having turned physics and biology on their heads, the story then follows its young protagonist on her quest to find the other survivors and re-establish a society. The book is fairly readable and entertaining, but seriously flawed, and not only because of its bogus science. It is extremely derivative, especially, but not exclusively, from the works of Robert Heinlein [3-A].

Comparisons of the heroine to Podkayne are inevitable, but she owes more to Friday [4], the supermen of "Gulf" and Heinlein's long tradition of "competent men." Palmer attempts to secure the readers' interest and sympathy by having as his protagonist an 11-year-old girl (an orphan twice over, no less), but, either attempting to make her survival more believable or just indulging in juvenile wish-fulfillment fantasies, he endows her with the aforementioned preternatural strength, senses, etc., not to mention a sixth-degree black belt in karate. With her bare hands, Little Orphan Candy kills two grown men and half a pack of wild dogs (arf!). Thus we are presented with Lazarus Long in a training bra, with Kimball Kinnison wearing a Girl Scout uniform instead of Lensman's grays [4-A]. It becomes difficult for the author to create a situation in which the reader seriously worries about her safety. He does manage it in the last segment in which she is shot into orbit aboard a gutted one-way shuttle on a suicide mission to defuse a planet-cracker bomb that the bad-guy survivors want to use to exterminate the good-guy survivors (or does this stoop to melodrama? [5]), however, owing to Mr. Palmer's somewhat heavy-handed foreshadowing, the readers have figured out well in advance what a whole village of supermen have failed to see, that is, how she gets home, even as we knew well before they did that she was going [6].

The setting is of course the Emptied World, a popular one in SF books and movies, usually associated with the last-man-on-earth sub-genre. The characters poke around in the largely-intact structures of cities whose occupants have been removed by some convenient agency ("The State Department announced today that the Red Chinese have exploded a plot device, and the cloud of fallout is headed this way, cough, cough..."). The idea of being alone, or nearly so, in an entire city seems to hold a peculiar fascination for urban man. It is an eerie feeling, easily experienced by taking night-time walks around a large college campus between terms. Heinlein doesn't seem to have used it, but lots of other writers have: Damon Knight, Ray Bradbury and Alfred Bester come readily to mind. Films: The World, the Flesh and the Devil, The Omega Man, Damnation Alley. Some episodes of The Twilight Zone, The Outer Limits, and even Star Trek that I can recall--it's a stock idea, OK? And there's nothing wrong with employing the occasional stock idea, but when you get the familiar character dealing with the usual problems as she moves across the stock landscape [7], you begin to feel that you are reading a prefabricated novel.

The story is presented in the form of a journal kept by Candy during her travels. It is written in a condensed version of English with most of the short words (I, is, it, the, an, and, etc.) left out. This, it must be admitted, is a courageous thing for someone being paid by the word to do, and it lends some versimilitude to the journal format,

but it makes it difficult to form an opinion of Mr. Palmer as a prose stylist. The conversations incorporated into the text do not suggest a sure ear for dialogue [8].

I have alluded already to the dubious quality of the science underpinning the story: for the author of an SF story so concerned with biology, Mr. Palmer seems unsettlingly uninformed about the science. He manifestly does not know what a species is, or how one is named [9]. "Homo post hominem" violates the first principle of modern taxonomy: the genus and species names must each be one word. The name was supposedly chosen by government scientists secretly studying them long before the war; apparently none of them were biologists. ("I know! Let's get some theoretical physiscists to study the mutants!" "Good idea, Mr. President!") Another glaring example is Candy's assertion, upon discovering some escaped zoo animals, that polar bears are not true bears but members of the mink family [10]. Ursus maritimus (formerly Thalarctos maritimus) is very definitely a member of Ursidae, not Mustelidae, as any encyclopedia or biology text could have told Mr. Palmer. The information is presented gratuitously anyway, in an attempt to impress the reader with Candy's erudition, and as such it backfires. If you are going to imitate Heinlein, imitate his virtues: he makes the effort to get his facts straight. (See Chuck Ott's "Uncle Bob's College of Gratuitous Knowledge" in PyroTechnics #30.)

Another annoying error, perhaps more minor but with even less excuse, is the consistent use of the word "histographer" to mean "historiographer," a writer of history [11]. A histographer writes about histology, the medical study of tissues. It is not credible that the character Candy is making the error: she has read widely in her adoptive father's medical library. The author (and editor!) are at fault here.

Is this all just carping? (Which is to say, is this all unjust carping?) I don't think so [12]. Words are the tools of the writer's trade, and the facts and ideas of science are the specialized instruments of the science-fiction writer. A writer who muddles or confuses these tools is like mechanic who has trouble telling a screwdriver from a wrench. An sf novel rife with scientific errors [13] is like an aria sung in C minor while the orchestra is playing in B-flat: it may be well executed, may be a work of art in and of itself, but it is not what it purports to be and does not do what it is supposed to do. And the contradiction grates.

Moreover, the inclusion of errors so readily corrected by simple reference to dictionary and encyclopedia bespeaks either intellectual laziness or contempt for the audience [13], traits that may bring success in politics or television scriptwriting, but not (not yet, at least, I hope, evidence to the contrary notwithstanding) in sf writing. On the other hand, if Mr. Palmer can be disabused of the notion that it is easy to be Robert Heinlein, he may become a creditable writer [14].

For I don't wish to give the impression that this is an entirely bad book. Some of it I liked very much. Though I don't believe that most of the nation's electric power grid would be functional months after the people operating it had died, some parts of the Emptied World were well-conceived: the trouble crossing the bridges and the ingenious solution, for instance [14-A]. The relationships between Candy and Soo Kim McDivott, her mentor and karate instructor, and between her and her macaw, are well and touchingly drawn. But I do think that, on the whole, the book has been over-rated [16].

Bill Higgins, on hearing some of the opinions expressed above, asked why I thought the book has been as popular, even among our circle of GT/fandom, as it has. Partially, of course, it is pure difference of opinion, and needs no explanation, but I feel that it is also partially due to the unfamiliarity of modern sf readership (alternatively known as "these kids today") with the basic sf canon. To someone who has never read the Emptied-World stories referred to above, or "Gulf", or Podkayne of Mars [15], someone unfamiliar with the long Heinleinian roll call (or role call, if you will) of educated super-predators, this book would seem to have a fertile originality that it does not, alas, possess.

(Apart from the heading and inside address, this is the complete text of Mr. Palmer's letter to Barry Gehm in response to Barry's review of EMERGENCE. The apparent ellipses (...) are Mr. Palmer's punctuation, not editorial elisions. Remarks inside square brackets are also his. Editorial insertions are enclosed in wavy brackets.)

March 4, 1986

Dear Barry,

Thanks for the opportunity to preview your review of EMERGENCE, slated for an upcoming issue of PYROTECHNICS. And please don't be uncomfortable about expressing your opinions: Despite the fact that your is the very first review I've received (out of 30-plus) which could be characterized as unfavorable, let alone a "hatchet job," I'm not angry; you have as much right to your opinion as all those professionals do theirs. And further, since democratic principles can hardly be counted upon as a reliable indicator of correctness (and always assuming that you didn't sit down with the specific intent of taking the opposite view merely to generate controversy), yours may even be the correct view; maybe "everybody is out of step but Jack." Accordingly, I find nothing about your opinion with which to take exception.

However, people tend to forget that a review is just one more collection of words on paper -- the product of a writer: one who has chosen to work in a terribly narrow and fiercely competitive field; a writer whose success of failure depends entirely upon the degree to which he can make people remember his work -- not necessarily the works he reviews. This conflict-of-interest is inherent in the nature of the task and lies at the heart of the antagonism which tends to divide "writers" from "reviewers."

For it is obvious that there are only two ways to establish a succesful review column: The first is to write interestingly, knowledgeably, and well about the story at hand, giving readers insight into why they may or may not wish to read the book under scrutiny, without disclosing more of the plot than is absolutely necessary. The other approach is unfailingly to take the minority view, dredge up a list of real or manufactured complaints about a book, and work hard to perfect a dazzling command of gratuitous vitriol with which to drive home the reviewer's viewpoint -- arguing from a conclusion rather than reaching one from analysis.

Regrettably, the latter approach is by far the more common choice for the up-and-coming, would-be reviewer because its lots easier and a much more reliable road to success. Even more unfortunately, widespread awareness that it is easier imposes upon a reviewer an additional (defensive) requirement not faced by writers whose work he reviews: maintaining a real and even (perhaps even more importantly) an apparent incorruptibility....

That's right; not only must a reviewer strive at all times to make sure that he is reviewing from his heart and intellect (not from a desire to achieve easy fame), he must take pains to ensure that by no stretch of the imagination can anyone misapprehend his motivation. He must bend every effort to avoid even the appearance of impropriety. That means he must have his facts straight. All of them.

From a technical point of view, as a writer you have few worries. When I decided to respond, I first thought it might be satisfying (in a small-souled sort of way) to butcher your review as a professional copy-editor would. I gave up that idea after about three paragraphs: Your writing style is clear, concise and non-redundant. To my way of thinking, you misuse hyphens, but your fondness for second- or third-choice dictioary spellings may be nothing more than an esthetic preference. A style-book question; none of my business.

I am, however, entitled to require of you at least the same standard of factual accuracy you do me. And in two and a third pages, you misstate four plot incidents cited to support your opinion, contradict yourself once, and imply that I have committed (to take the kindly view) an attempted Heinlein pastiche. Thereafter you get vague and/or indulge in slapstick hyperbole (don't bristle; I'm entitled to my opinions, too) disguised as analysis. The misstatements are serious breaches which might well lead a reader of your column wrongfully to assume that my book is incapable of suspending his disbelief; that could cost me sales. The contradiction is identified below along with a brief discussion of my perception of the various innuendos and/or stylistic evasions of analysts' resposibility of which I consider you guilty. (The marginnotes [they can't be footnotes because they're in the margin] are furnished to allow us to discuss specifics more readily. {These notes are the bracketed numbers which have been incorporated into the reprinted review -- BG.})

1. Misstatement: The two-stage virus was seeded across the entire world, not just the U.S.

1-A. Misstatement: The attack was planned and set in motion by the Khraniteli using the resources of the U.S.S.R.; not by the Russians themselves.

2. Misstatement: The shelter was built by, and belonged to, Candy's adoptive father.

3. Misstatement: Superhuman strength was never described as characteristic of H. post hominems; "hysterical" strength is available to H. sapiens as well. You can do it, I can, anyone can -- given sufficient motivation or proper hypnotic conditioning.

3-A. Guilty -- without apologies. The work of a student is apt to reflect his impression of the best of his favorite teacher. Any resemblance was unintentional, but comparisons which suggest it might exist tickle me pink.

4. Innuendo (unintentional, I'm sure): 3-A notwithstanding, you appear to be unaware of the fact that the EMERGENCE and SEEKING novellas (Vols. I and II of the EMERGENCE novel) were written and appeared in ANALOG before FRIDAY hit the stands. It was manifestly impossible for me to have cribbed anything from FRIDAY. In fairness, however, RAH himself called be to discuss the similarities between the characters and some of the situations after FRIDAY came out. He had a vague recollection of having read the EMERGENCE novella but had not read SEEKING prior (to) writing FRIDAY, and needless to say, was and is influenced by no one. (I, on the other hand, try to be influenced by everyone who writes well. Spider Robinson observed that THRESHOLD is slightly reminiscent of Keith Laumer, another of my favorites. It will be interesting to see who I'm accused of mimicking when I finish SPECIAL EDUCATION. [Maybe I should deiberately copy the styles of several different writers in different sections and see how many reviewers identify....]).

4-A & 5. Well-done, understated sarcasm has its place and is very effective; redundant sarcasm is amateurish and trashy. If you can do that, I can stoop to melodrama.

6. I'd probably have something equally clever to say about this sentence fragment if I understood it, but I don't. I suspect you won't either when you reread it. However, since I've had sentences get away from me, too, during preliminary drafts, I'll resist the temptation to point out that I managed to avoid including something like that in the entire 462 pages of the final draft of the EMERGENCE manuscript, while your review is only two and a third (five, in comparable format).

7. Contradiction: See 14-A.

8. Mea culpa. You'll tecall from our "Hour With..." session at the con that I, too, recognize that I need to work on my dialog skills. So far, though, you're th only reviewer and/or reader to catch me at it -- good work...!

9. Lacking data on your education, I'm forced to assume that you're better educated even than Stanley Schmidt, Ph.D. (editor at ANALOG), David Brin, Ph.D. (NASA consultant as well as author of SUNDIVER, STARTIDE RISING, etc.), and all those folks from the University of Florida listed on the "thank-you" page; none of whom disputed my fictional extensions of existing science, and none of whom objected to the name H. post hominem. In fact, most thought it was a neat, logical extension of our species' name. Personally, I think modern taxonomy can survive the occasional well-intended fictional exception. After all, how often does a new species of Man come along?

(And this is, after all, a fictional story. That criticism reminds me of the letter I got from a reader complaining that the track width of a Chevy van didn't match the spacing of railroad tracks closely enough to permit Candy's tightrope crossing of the railroad trestle. Mind you, Chevy did not at the time [and still doesn't] make a four-wheel-drive van. The few aftermarket shops which performed such conversions then used a variety of components boasting a range of track widths. ...None of which is the real point: This is fiction...! Nowhere in the story is a specific year or car model suggested; neither is there any reason to assume that the rules of taxonomy practiced here and now will be in use then and there. A lay reader can be excused for superimposing his own assumptions and prejudices onto a story and reading into it what he expects to find rather than what's there; a reviewer should know better.)

By the way, the two-stage virus and flu-based, delayed action genetic recombination were the devices of a grad student at Tulane who spend five years working and publishing in the field of gene splicing research before embarking on her current MD studies.

10 & 11. Two for your side. I rechecked Random House and they agree with you: A "histographer" is not one who records history. Either my eye jumped a line, or I was guilty of "seeing what I expected rather than what was there" when I looked it up originally. And polar bears are not minks or weasels -- though I was so certain they were that I called up the zoology department at UF and triumphantly demanded confirmation, explaining that I was a writer being pestered by a gadfly critic who thought they weren't. The zoologist with whom I spoke was apologetic but resolute, and corrected me without reservation. For the life of me, I can't imagine where I got that impression, but I was absolutely confident of my ground on that question. Heretofore.

(Incidentally, this is another example which gives me pause [and should you] concerning the purity of your motivations as a critic -- or at least the impression of them projected to the reader: Candy's little discourse was not "an attempt to impress the reader"; it was mentioned in hopes of quickening his pulse rate. Your wording amounts to a flat, unsupported accusation. If you really suspect a writer of trying to show off, phrasing it as a possibility raises the question without leaving you open to the conflict-of-interest charges discussed above.)

12. I do.

13. "Rife with scientific errors" would seem putting it a bit strongly. I'll grant you one clear scientific error and one word-choice good in 462 manuscript pages, and I won't make the obvious comparison between our respective error-rate-per-page count. Further, though my research sources don't back down from their opinions, that support doesn't impel me publicly to accuse you of intellectual laziness or contempt for your audience merely because you may still disagree with them.

14. See 3-A above.

14-A. Contradiction: See 7 above.

15. Is PODKAYNE OF MARS really an Emptied-World story? I must have missed that.

16. This one reminds me of the playwright who, when attending the premier of one of his plays, found his attention drawn to the single man (out of a houseful of madly cheering patrons) in the fron box who kept hissing nonstop. As the crowd became aware of the problem they fell silent. The hisser, aware now that all attention was focused on him, grew even more enthusiastic. The crowd expected an outburst, but the playwright merely smiled. "Personally," he called to his heckler, "I agree with you. But what are our opinions in the face of so many...?"

Mind you, I don't agree with you. As I said at the con, I wrote EMERGENCE to please myself. And but for the two errors which you've brought to my attention, I wouldn't change a word. Can you say the same about your review at this point?

Actually, apart from a tendency to misremember vital facts and engage in judgmental pronouncements which lean a little far in the direction of unsupported and unsupportable accusations on a personal level, I think you've probably got the makings of a pretty good critic. You're generally perceptive, you write well and amusingly. If you keep that up, and work on developing a truly analytical style, I think you have a chance of making a living at it one day.

Or better yet, turn that abrasive energy and originality to a useful purpose: Write books of your own. You can do it; they'll be worth reading -- and I promise not to review them....

Very truly,

David R. Palmer

(Reply From Barry Gehm to David R. Palmer, 3/13/86)
Dear Mr. Palmer,

Thank you for your letter, especially for your advice and encouragement. Although I stand by most of the comments in my review, I wish to publicly apologize for the inferences I made about your intellectual industry and attitude toward your readers. These should not have been made on the strength of one book's reading; they are also wrong. On the basis of your letter and your talk at Capricon I would tell anyone that David R. Palmer is a true gentleman, and also that he answers letters quickly -- a courtesy not extended to me by many with more cause to be courteous.

I am not attempting to build a career as a reviewer upon a mound of writers' skulls. My career goals lie in other directions, which is fortunate, since I am only an inexperienced amateur writing unpaid copy for a fanzine that comes out at ludicrously irregular intervals (although the prospect of reading books for a living does have a certain fascination ...). I assure you that I did not form my opinion of EMERGENCE for the sake of controversy -- I formed it when I read the book, prior to any idea of reviewing it. I decided to review it, i.e., to put that opinion into print, for several reasons:

a) Jamie & Gail needed copy for PyroTechnics.

b) Pyro is oriented toward "hard" sf, into which category your book seemed intended to fall.

c) At the time the review was written (before the 1985 Hugo balloting) it was topical.

d) EMERGENCE was popular, so that many of the readers of Pyro would have read or heard of it. Also, I thought a dissenting opinion (honestly arrived at) would be more interesting than, for instance, one more person saying of FRIDAY, "Boy, is this better than THE NUMBER OF THE BEAST!"

e) In reviewing a book, one has some hope that one may influence the author's future development by pointing out those things that were done well or poorly. New writers naturally tend to be more susceptible to such influence than established writers. If I write that FOUNDATION'S EDGE is a failure in conception and execution (which I think is true) it is unlikely to cause even a momentary pause in Asimov's typing. You, on the other hand, having been made aware that someone considered EMERGENCE seriously flawed, were moved to write a 4-1/2 page letter in reply. I cannot say if I have affected your future writing, but it is obvious that you have at least thought about what I have said.

Though perhaps not very carefully -- of the four "misstatements" you tax me with, two are accurate as written and one derives from an inconsistency in the book itself. The specifics, and responses to some of your other numbered points, are presented below. (Page numbers cited are from the Bantam paperback edition.)

1. Guilty with an explanation. My notes were taken from Candy's summary of the attack on p. 20: "Entire country seeded...with innocuous first-stage... "

1A. Guilty. When I was trying to condense the background of the novel into two paragraphs, the distinction seemed unimportant. I see now that it isn't.

2. Not guilty. The word "her" need not denote deeded ownership; I can talk about "her hometown" without implying a fiefdom, or "her karate instructor" without implying chattel slavery. She was the only person in the shelter (and the presumptive sole heir of the deceased owner of record); it is perfectly legitimate to refer to it as "her shelter."

3. Not guilty. "Hominems" are described as stronger than humans on pp. 39 and 54 (also quoted on interior blurb page). To this is added Candy's ability to activate hysterical strength at will as a result of her karate training, reinforcing my contention that the character is over-endowed to the detriment of the story.

4. Your point about publication dates is well taken, though I never meant to suggest overt "cribbing." Heinlein has been using this basic character type so long and so consistently that it doesn't much matter what name or sex he assigns. Friday, to extend my metaphor, is just Lazarus Long in drag. My point was that Candy shows signs of being cut from the same cloth.

4A. "Lazarus Long in a training bra" illustrates as trenchantly as possible my difficulty in sustaining my belief in the character as an 11-year old girl. If you find it trashy, so be it. De gustibus non est disputandum.

6. I find this sentence clear in meaning, albeit somewhat convoluted in structure, but then, my brain has been warped by exposure to German. My meaning is that although Candy's Awful Realization that she must be the one to defuse the orbital bomb comes as a shock to her and the other genius AA's, and seems to be intended as a shock to the reader, this reader, for one, saw it coming pages earlier. Ditto for the idea of using the defused bomb as a ride home.

7 (and 14A). Partial mitigation of a previous criticism does not constitute a contradiction. Much of the background and many of the situations seemed typical of After-the-Big-One stories; some did not. The initial criticism was placed in a discussion of the story's weaknesses and the qualification came later, in a listing of its strengths.

8. Thank you. Keep plugging.

9. Your defense of the name Homo post hominem by reference to Chevy van body styles and an unspecified future date amounts to special pleading. The technological and social milieu of the story is clearly late 20th century. The binomial system of biological nomenclature was established by Linnaeus 250 years ago, has been going strong ever since, and is hardly likely to be abandoned in the next few years. Why not just admit that you didn't know something that someone who undertakes to make up names for species, even in fiction, ought to have known?

Having your science vetted by people like Schmidt, Brin, etc., is a good idea (wish more screenwriters would take the trouble) though no substitute for the real thing. Whether through inexpertise or inattention, they let some outright errors and some real credulity-stretchers get through. In my review I gave perhaps too much wordage to the minor errors and too little to the errors in the background science. To be more specific:

"Species." A group of individuals living among, sharing the same habitat and "ecological niche" with, and interbreeding freely with, H. sapiens, cannot be considered a separate species. I would admit subspecies, variety, type or race, but definitely not species. You laid considerable emphasis in your talk at Capricon on the importance of finding the perfect word. "Species" isn't it.

Origin. I quite agree that viral infection can produce genetic rearrangement. To believe that a single such mutational episode can produce complete resistance to all disease, and superior strength, and quicker reflexes, and genius intelligence, and more acute senses, without any discernible disabilities, and to further believe that a large number of people would be thus affected in essentially identical fashion, is to display an understanding of mutation scarcely more sophisticated than that found in The Uncanny X-Men. It isn't science, not even extrapolated science, it's magic.

Virus. It is quite easy to believe that a virus that will mutate from harmless to pathogenic can be engineered, but the idea that the mutation will take place only in response to a particular wavelength of nuclear radiation is silly. X- and gamma- radiation cause mutations by breaking chemical bonds in nucleic acids, either directly or by producing activated chemical species (unstable ions and free radicals) elsewhere in the organism that then react with the nucleic acids. Environmental radioactivity, ultraviolet light, and many chemical mutagens produce this same sort of genetic damage. Seed the environment with a virus like that and cases of the plague will soon break out, bombs or no, as the viruses are exposed to sunlight, polluted water and nuclear waste dumps. The notion of a long, controllable latency is untenable.

I also have grave doubts about the idea that nuclear explosions can be tuned to emit a particular wavelength of gamma radiation -- it strikes me as similar to trying to get TNT to explode in C-sharp -- but this is outside my area of expertise.

As far as my education is concerned, I am in the final (God willing) year of research for my Ph.D. in biochemistry at Michigan State. [He wasn't: the degree was completed 2 years later, in early 1988.]

10. Regarding my ascription of the introduction of the polar bear-mink relationship to "an attempt to impress the reader with Candy's erudition": I was not accusing you of showing off. Demonstrating Candy's intelligence and education to the reader is a legitimate part of characterization -- if it works. As to your stated purpose, I confess that it never occurred to me that polar bears -- huge, powerful, voracious -- could be made even more fearsome by allying them with animals whose skins society matrons wear to the opera.

12. This is going to be a matter of individual opinion, of course, but the flaws of which I am complaining (not just polar minks and histographers, but the shaky scientific underpinning, Heinleinesque superhuman character, etc.,) certainly interfered with my suspension of disbelief and significantly decreased my pleasure in the book. That is where I would draw the line between serious complaints and "just carping."

15. I don't understand this comment. "Or" does not mean "such as," it means "or." Please reread the sentence.

16. I like the anecdote about the playwright. For what it's worth, Bennett Cerf [TRY AND STOP ME, 1944] claims it was George Bernard Shaw.

I thank you again for your kind words of encouragement. I will bear in mind what your advice about keeping the purity of one's motives apparent, though I don't think it has to entail pulling one's punches when punching is called for.

If I might presume to offer advice as well, it would be remarkably similar to your closing words to me. You are not without talent; you created some memorable scenes in EMERGENCE. (Please don't accuse me of contradiction again -- I said I liked some of it very much.) I know you believe yourself to work very hard at writing. I suggest that it may require even harder work. They don't call it "hard" sf for nothing.

Write books of my own? What, and have my prose picked apart by know-it-all wiseguys like me? Seriously, if I ever do, I promise to send you a review copy. Fair's fair.

Sincerely,

Barry D. Gehm

Cheshire in Rocketland

Richard Cheshire

The "Educators" bus (that's what it says on the roll-sign) is loading up for the trip to the Kennedy Space Center. The Trip Coordinator from the group of educators is busy herding the fen (the plural form of "fan" in the Science Fiction community) onto the bus, as our guide takes his position as tour guide of the main scheduled event of the "Travelling Fete", as it's called. Our guide this afternoon is the Guest of Honor of the South Florida Travelling Education Conference. He is Joe Green, a technical writer with NASA, who also has a number of science fiction books to his credit.

The bus pulls out of the parking lot of the Merritt Island Holiday Inn, and heads down route 520 for route A1A, and in through Gate 1 at the Cape Canaveral Air Force Station. First stop, the Mercury launch complex.

When I moved to Titusville a year ago, I used my first free weekend and went to the Space Center. I took the Blue Tour, which took in the historical sites of the Cape Canaveral Air Force Station. We had gone out to Complex 5/6, and walked around the Mercury pad, but we had not gone into the blockhouse. This trip we did!

Looking at the old equipment shows how far we've come in twenty years of miniaturization of electronic and computer equipment. Why, the Model-100 lap-top computer I wrote these notes on was more powerful than the computing power available in the block house for those early launches. Another amazing thing was the closeness of the blockhouse to the rocket itself. It was only about 500 ft from the launch pad.

When asked how come our group could visit the blockhouse and the regular tour couldn't, Joe held up a small object and said, "Because I have the key". While the Air Force controls the Air Force Space Museum, NASA controls access to the blockhouse. The museum consists of a "Rocket Garden" of old missiles and equipment that the public can walk around and view.

Joe wasn't sure if one of the roads was open, and we'd be miles going around the other way. He started looking for a phone. I suggested my ham radio autopatch, and discovered I was too far from either the Titusville, or Cocoa Beach repeaters, which have the interface to the telephone network. Fortunately, I was able to raise someone on the Space Port Radio Club repeater, and he placed the call checking on the road. The report came back that all roads were open, and we were well on our way again.

We passed the Cape Canaveral lighthouse, which is more than a hundred years old, and still in active service. Like most anything at the space center that's more than 10 ft off the ground, it has sprouted radio antennas.

A stop at the Mercury Seven memorial was mostly to read historic plaques, and photograph the stainless steel structure with a "7" in a symbol for Mercury. I *know* that I can buy a better picture in the gift shop, but I took one anyway. After all, you don't often get onto a secure military installation for such trivial pursuits as sightseeing.

Joe was able to to get us ONTO pad 39A (NASA goes out of its way for educators, you know - it's our enthusiasm that infects kids with the science bug). The shuttle is currently sitting on pad 39B. We could stand there and look at the Rotating Service Structure, as Joe explained how payloads are lifted into storage areas on the Service Structure, and after the orbiter is delivered to the pad by the crawler on the Mobile Launch Platform, the service structure is rotated around, the cargo bay doors are opened, and the payloads are loaded. Major payloads, such as Spacelab and the Long Duration Exposure Facility, which take up a major portion of the cargo bay, are loaded into the orbiter before the space ship is taken to the VAB (Vehcle Assembly Building) for Stacking.

While driving back to the VAB and the Launch Control Center, we had to pass Pad B where Discovery stood on the pad. Of course, we wouldn't be able to get off the bus here, as it would be unsafe for us to be in an actual work area. In fact, in order to be entirely safe, our driver had to go v-e-r-y s-l-o-w-l-y past the pad to be sure there was no possibility of our having a traffic accident near the pad.

Fortunately for the photographers on the bus, there actually *was* some traffic on the roads, and we had to wait for it to pass so we wouldn't obstruct traffic. And so some good closeup shots of Discovery on the pad were available from the bus window. With the Rotating Service Structure covering the orbiter and protecting it (and of course, the fragile heat tiles) from the elements there wasn't much to photograph, but the External Tank and Solid Rocket Boosters were still visible.

We didn't have enough tour escorts for our group to allow us to visit the VAB, but we did stop at the Launch Control Center. It was about 3:30 on a Friday afternoon, and it looked like the weekend was about to begin; people were leaving in droves. You have to realize that many people start work out here at 7 or 7:30 AM.

After the VAB, we were allowed to crawl around and under the Crawler, but we could not leave the ground. That is, we could not climb the ladders onto the crawler. The caterpillar tread alone was nearly as tall as our tour bus!

The bus then drove *under* the mobile launch structure. Of course, this is what the crawler does. It then picks up the launch structure, and rolls it into the VAB. The spaceship is then "stacked" on the mobile launch structure. The entire launch structure and Space Shuttle is carried to the launch pad on the back of the crawler. The Mobile Launch Platform is then left at the launch pad until after its precious cargo leaves the pad under its own power, just under 7 million pounds of thrust at launch.

The bus then took us to the old Flight Crew Training Building. An actual Apollo Command and Service Module, and a real Lunar Lander are on exhibit here, and are part of the regular tour. The Apollo spacecraft was the backup for the Apollo/Soyuz mission, and the Lunar Module was a backup for Apollo 17. The tour then moved into the re-creation of the Apollo Firing Room. One of the regular tour groups came in behind us, and we were ready to take in the next show with them.

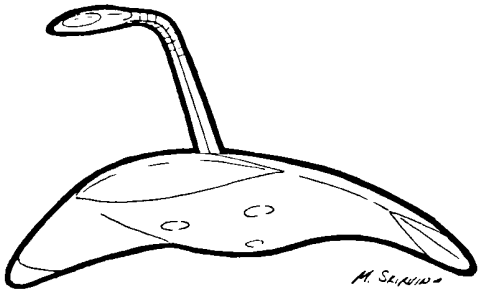
In this room, the time is always 9:32 AM, the date is always July 16, 1969, and the countdown clock starts off at T Minus 3 minutes, 15 seconds and holding. The multi-media show lights up the display consoles, and shows the status of the Saturn V before it launches. It shows the sequence of fuel pressurization in the final moments of the countdown, as the projectors switch in film from different parts of the launch pad, and launch control center. At Liftoff, we watch two separate cameras at the same time as the Saturn V rocket (which had built up thrust since the engines were started at T-9 seconds) slowly deigned to rise off the pad, taking a full 11 seconds to clear the top of the launch tower. The film was nothing like being there, but it's really worth the show.

After leaving the training facility, the ol' bus headed back on Nasa Blvd to route 3, took a left, and headed back to the hotel. It was a combination of the Red Tour and the Blue tour (both available to the public, but combined is referred to "The Full-Bore Tour"), with a couple of "minor additions" that the public just couldn't get.

Richard Cheshire is a Central Florida based Science Fiction fan who is interested in the Space Program, and hacks computers for a living. Richard Cheshire is not the author's real psuedonym. His real psuedonym is The Cheshire Catalyst. Robert Osband, Computerist and member of General Technics, uses these names when his works are to appear before the general public.

Cape Who?

Shortly after the assassination of President Kennedy, the Congress changed the name of Cape Canaveral to Cape Kennedy. For a number of years thereafter, many historians and local groups did all they could to get the name changed back. The main reason for the hub-bub was that Cape Canaveral was named Cape Canaveral more than a century before Cape Cod was named Cape Cod. Now if those wiseacres had wanted to name Kennedy's own cape after him, that would have been all right with the Floridans. The current status of names along the Florida coast is that Cape Canaveral is once more the name of the cape, and the Kennedy Space Center is the name of America's spaceport. The city of Cape Canaveral, which is south of the navigational point with the disputed name, has never changed its name. -RC



Water Rises To The Level Of Its Source

Joachim Schürmann

WATER RISES TO THE LEVEL OF ITS SOURCE

In the mid-seventies I read a book which impressed me very much and that I recommend to everybody who likes engaged fiction novels: "Homo Faber" by Max Frisch. At a certain point the main character of the novel talks to somebody about Roman engineers and their organizational talent and perseverance but complete lack of original thought in completing their great constructions. As an example for this claim, he mentions the Roman aqueducts.

Max Frisch's characters draws a sketch of a vertically held u-shaped glass pipe filled with water and shows that the level of water is identical in both legs of the u-shaped pipe. He claims: "Had the Romans had this little sketch, they could have saved themselves a lot of work building bridges and tunnels for the aqueducts."

We all know that the Romans had a commendable obsession with cleanliness and are very much known for the aqueducts which they built to supply their cities with water. This water would be used as drinking water and bath water, and would therefore need to be rather pure and unpolluted. To ensure a plentiful supply of high grade drinking water, Roman engineers would bring it in from some nearby mountain range, often over distances of fifty or more miles.

In order to bring the water into the cities, they built small canals which had a very gradual and constant slope in which water would steadily flow downhill from the source to the city. This of course required that natural obstacles be mastered. Where they could not be circumvented, tunnels and bridges had to be built. The grandiose results of the masterful construction skills thus displayed can still be seen in the European countryside. It even appears that the Spanish city of Segovia is still actively using a Roman aqueduct for today's fresh water supply.

Now, the point made above is that the Roman engineers could have saved much work if they had used closed circuit pipes rather then open canals. In that case it would not have been necessary to perform much bridging and tunnelling. It would have been sufficient to put some pipes on the ground, following the contours of the landscape. Provided that the pipe outlet would be kept lower than the pipe intake, water would have flowed, without the requirement for a gradual and constant slope. These days the same principle is used in every public water supply.

Does this imply that the Roman engineers did not know about the principles that govern the distribution of liquid in a closed pipe system? I always had my doubt about this, because, you see, they did know about pipes. A short visit to the thermal springs of Bath in Great Britain or to the ruins of Pompeji is enough to bring evidence of the skilful use of lead pipes in their water distribution system.

Recently I have found some reference to this problem and I would like to share it with you. In "Engineering in the Ancient World" by J. G. Landels, the author states that "it is absolutely clear from the writings of Archimedes, Hero and Vitruvius that they all fully understood the pressure-equilibrium principle". Alexander Purvis Gest in "Engineering - Our Debt to Greece and Rome" even contributes a quote from Pliny's (the Elder, A.D. 23-79, died during rescue action in Pompeji) Natural History (XXXI. 6. 31. 57): "Subit altitudinem exortus sui." Provided that the subject of this sentence is "aqua", it means something like: " Water rises to the level of its source." The principle therefore must have been known to the Romans at the time of Pliny the Elder.

I would also like to point out that archeological excavations have brought to light the reminders of a pressure-equilibrium based closed-pipe water distribution system for the Greek city of Pergamon. J. G. Landels indicates that this system was built in the reign of King Eumenes II. This would indicate that the system was built between 197 and 159 B.C. Pursuant to the testament of Attalus III in 133 Pergamon became a Roman province. Archeological evidence shows that the Romans promptly proceeded to replace the closed-pipe system with an open-channel system of proven design. The Romans were very practical people. It is hard to believe that they were replacing a properly working system.

Sextus Iulius Frontinus was appointed superintendent to the City's water supply in 97 A.D. He left us his "De Aquis Urbis Romae" (About the Water Supply of Rome City). He lists nine aqueducts that at his time were providing Rome with fresh water. Six of these aqueducts were built after the kingdom of Pergamon became a Roman province. It follows therefore that the Romans deliberately chose not to adopt the closed-pipe system, although they had seen it in use, or maybe because they had seen it in use.

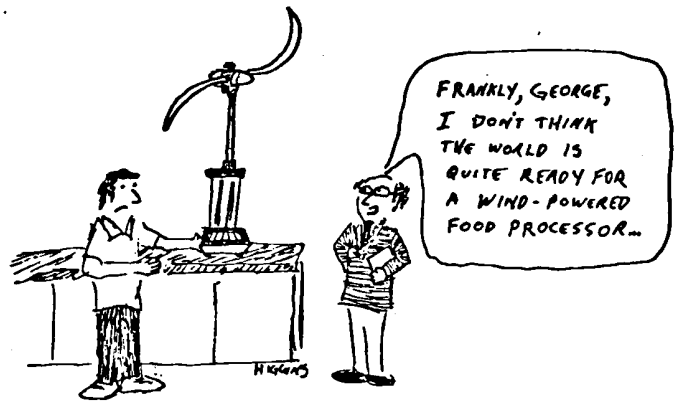
There could be two good reasons for preferring the open-channel system to the closed-pipe water distribution system: Reliability of building materials and maintainability of the structure.

In his book "Engineering in the Ancient World" J.G. Landels determines that the point of highest pressure in the closed-pipe system for the city of Pergamon must have been around 18.5 kg per square centimetre. A rather high pressure for the simple building materials and techniques available at that time. It is conceivable that such a system of pipes, made of clay, lead, or, at best, bronze, may have been leaking and loosing pressure quite a bit.

However, maintainability may have been the decisive factor. Once constructed, a closed-pipe conduit is not accessible to maintenance and if it becomes blocked, it may have to be dismantled and rebuilt. However, an open channel aqueduct can be cleaned and inspected while in use.

After a close look it appears therefore that the Roman engineers did not persist in the open

channel architecture out of ignorance, but for very practical and solid (excuse the pun!) reasons. The many centuries of use and abuse which their aqueducts endured are a quiet testimony to the soundness of their choice.



Ask Dr. Techie

Got a question that's been keeping you up nights, but you don't know where to look it up, or you're just too lazy? Is that what's bothering you, bunkie? Now there's hope! Just mail your question to ASK DR. TECHIE at the Pyro mailbox, sit back, and wait for enlightenment to strike. Today's question comes from an anonymous coward....

Q. What's the difference between silicon and silicone?

We submitted this question to Dr. Techie, and shortly before press time, we recieved the following reply: Silicon makes things smaller, and silicone makes things bigger. *along with a voucher for "research expenses" at several Las Vegas night clubs. We then turned the question over to Dr. Barry Gehm, whose credentials include a former position as second-string fullback for the Michigan State University Department of Biochemistry intramural soccer team. What his answer lacks in brevity, it makes up for in length:*

Silicon is an element. Although it is very common (literally as common as dirt), it never occurs naturally on Earth in its elemental form, but only combined with oxygen in compounds called silicates. Silicates make up the bulk of the Earth's crust and mantle. The simplest silicate is silica, or silicon dioxide, which is familiar as quartz and sand. "Crystal" balls, if truly crystal, are carved out of quartz; less expensive ones are made of glass (a silica-based non-crystalline mixture). Some New-Age crystal hucksters are touting their wares as containing silicon, "as used in computers." True enough, but sheesh, so does a handfull of mud. (Which might make a nice visual/tactile aid if you wanted to point this out to one of them.)

Preparing elemental silicon is fairly difficult, and was not achieved until the 19th century. The major method for commercial production involves heating silica and carbon together in an electric furnace. The carbon strips the oxygen away, burns off, and leaves silicon, a hard dark-gray solid, behind. Rigorous purification is then required before the silicon can be put to its best-known use, micro-electronics. Silicon is the most widely used semiconductor; most transistors and essentially all integrated circuits are made from silicon. "Solar batteries" (photovoltaic cells) are also made from silicon. Since silicon is much more transparent to infrared light than glass, silicon lenses are sometimes used in infrared optical systems.

Silicones are a particular kind of compound made from silicon. They have a silicate-like backbone of alternating silicon and oxygen atoms, like so:

-Si-O-Si-O-Si-O-Si-O-

but, since silicon has a valence of 4 (that is, each Si atom tries to form 4 chemical bonds), each silicon atom in this structure can form two more bonds. In silicones, these bonds link the silicon atoms with organic (carbon-containing) groups of atoms, like methyl (CH_3) or phenyl (C_6H_5) groups. Silicone rubber, for instance, consists of very long linear polymers of the $(CH_3)_2SiO$ unit, tens of thousands of them strung together. By changing the length of the polymer, the identity of the organic side and end groups, and the degree of crosslinking (connections between silicon-oxygen chains), other physical states can be produced, from liquid (silicone oils) to semi-solid ("Silly Putty") to hard plastics. Silicone glues come out of the tube a stiff liquid, but when exposed to air, they form cross-links that make them set into a rubbery solid ("room temperature vulcanizing").

The combination of a mineral-like backbone with hydrocarbon attachments gives silicones interesting properties. The molecules slide past each other pretty well, like oil molecules, but the Si-O and Si-C bonds are very strong, so silicones are very stable and heat-resistant. The monograph I'm cribbing most of this from (Eugene Rochow's Organometallic Chemistry) shows a photo of a hand pressing down on a 1/3" thick sheet of silicone rubber. On the other side an oxyacetylene torch is directed against the imprint of the hand. The hand had been held in place (presumably voluntarily) for a minute, and was not yet uncomfortably warm. Silicones are also relatively unaffected by cold. The same book shows photographs comparing the behaviour of a natural rubber ball with one made of silicone when both are cooled to -80° C. and dropped on a hard floor. The natural rubber shatters, but the silicone ball bounces normally. This resistance to heat and cold also makes it possible to create greases and oils that don't get too thick when cold or too thin when hot. Useful stuff if you have, say, a jet engine on a plane stationed in Alaska (or Siberia) that has to start at 40 below and operate at 1000 above.

If silicone rubber stays flexible in extreme cold and resists extreme heat, why aren't shuttle booster O-rings made of it? Unfortunately, silicone rubber is not impervious to hydrocarbons: it will soften and slowly dissolve in grease and oil, including the grease that is used on the booster casings. The O-rings are made of Viton, a Teflon-like elastomer that resists grease, but, to our sorrow, lacks silicones' wonderful thermal properties.

Silicones are also unreactive biologically, making them useful in reconstructive or cosmetic surgery. Silicone rubber has been used to replace lost or damaged cartilage, and silicone bags full of silicone oil are used as breast implants. (Recently there have been some reports that this procedure causes cancer in rats. The reasons for this, and the significance to humans, are unclear.) Originally, silicone oil was simply injected into the breasts, but the stuff had an unpleasant tendency to wander around. Women who wanted bigger busts could wind up with bigger ankles. *Vive la difference!*

In sum, silicones are a diverse group of organo-silicon compounds with a variety of uses; silicon is an element used primarily in electronics. Saying one when you mean the other is a good way to annoy any chemists in earshot.

Guy 1, Surly Bonds 0

Guy Wicker

August berserkers have been a regular GT event for about 8 years now. Before Worldcon there is a lag in the summertime convention activity, and if someone can come up with something interesting to do, a group of techies will be attracted together. Past activities have included hamfests, airshows, weddings, dome smashing, and inner tube river rides. Having a Houghton berserker has never been a consideration, however, because of the distance. Techies will only go so far. Two years ago enough interest was finally generated to try it. It was a big success, so this year marked the second Houghton berserker.

Having Houghton berserkers serves an important purpose. The MTU Science Fiction and Fantasy Society was at one time a major force in General Technics. But, after the graduation of the core group, PFRC was abandoned by GT and now there is little contact between the two groups, and very little new membership in GT. Having berserkers local to Michigan Tech has re-acquainted the two groups, hopefully for the better.

Houghton has one main thing to offer; it's desolate. A berserker there has to exploit this. Alice Bentley wanted to try a camping berserker, so that was part of it. There are

places in the Upper Peninsula that are seldom seen by man and offer the most desolation you can find east of the Mississippi. Unfortunately you can't camp in too desolate an area, since not everyone wants to rough it. The more urban setting of Mclain Park was therefore chosen. This offered the feature of more bathroom facilities than any berserker in history. For those who wanted things more primitive, at least we slept in tents.

Techie activities that can't be done in populous areas were a big attraction. That means high explosive experimentation. Rockets beyond the Estes class, projectile weapons and mortar launched fireworks were abundant.

The first Houghton berserker last year was a big success. About the only problem was the dryness beforehand. A lot of the explosives work was prematurely aborted due to concern about the low rainfall. The concerns were unwarranted, though, because a heavy rain came 3 days before the weekend. This year it wasn't that good. The nationwide drought persisted right up to the week before the berserker. The rainfall beforehand was sufficient to lift the state ban on burning but the ground was too dry to set off the industrial explosives. Certain rocket failures even led to grass fires. Great fun!

Another project pursued at the Houghton Berserker is ballooning. GTers have been playing with helium and plastic garbage bags for a number of years, coming up with ever more spectacular radio controlled blimps. In implementing such a scheme on a larger scale you soon discover that helium is very expensive. Hydrogen is cheaper, offers 1.1 times the lift, and only suffers from one drawback, which at a berserker of this nature, is turned into an advantage. The object, of course, is to lift yourself with the balloon. At 1.1 oz of lift per cubic foot; weighing 155 pounds, with 30 pounds of polyethylene plastic bags and 10 pounds of rigging; 16, 197 cubic foot cylinders of hydrogen would just do it. $90 worth of dumpster sized plastic bags and $275 of hydrogen, $20 of 4" wide transparent tape and $9 of string is all it took. Eleven "balloons" were made by taping two of the plastic bags together. One of those was supposed to be a spare. Unfortunately my volume calculations were a bit optimistic. Two more balloons were fabricated on the spot. Seam quality was not good and only 5 balloons held all of their hydrogen. The one advantage to using many balloons was that after the experiment failed it offered several rocket targets.

The next years attempt was done with plenty of margin. 21 cylinders. Instead of 11 or 13 balloons, There was going to be a single 50 foot long 15 foot diameter cigar. I was later persuaded to split this into two 25 foot balloons for safety reasons, though I don't know what could be safer than weightlessness. Much research into making airtight seams in 4 mil polyethylene plastic led to using hot glue, then covering the seam with aluminum foil and ironing it. The hot glue melts along with the plastic to make a seam stronger than the bag. It all worked out, and everyone who dared got to float around (as long as they weighed under 160 pounds). The only thing that didn't work out ideally was Tullio's idea of using half inch magnetic computer tape as netting material. The nets broke in many places leading some to believe that the project was actually unsafe. Still, it had to be done that way. It is much more esthetic to use "scrounged" computer tape and save $10 on string (read George Ewing - "Living on a Shoestring" to understand the esthetics of risking your life to save $10 of string on a $500 project).

Next year I'd like to lift a 50 pound gasoline engine along with the person and possibly build a permanent vehicle. Pedal power is another option. In order to make it more permanent, a structure of some sort will have to be built in advance, and something better than polyethylene plastic will have to hold the hydrogen.

Then there's this idea I have for a small thermonuclear device....

[Forget it, Guy: I'm not loaning you my uranium! - BG]

SCENES WE'D LIKE TO SEE!

Biodata: Joachim Schürmann

Born in Milano, Italy, on June 2, 1955, I grew up as the only child of German immigrants. I went to the German School in Milano and then studied economics at the Bocconi, a small specialized college in the same city. I graduated with honours in Political Economy.

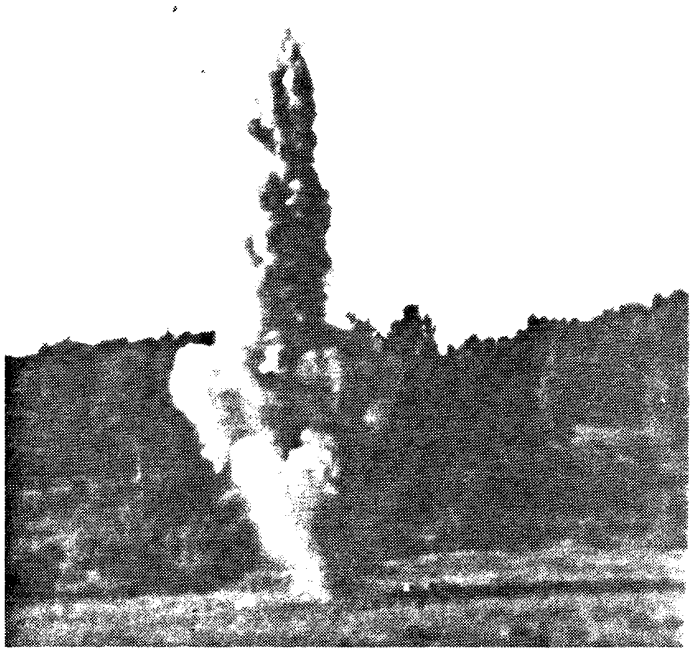
Since I like to investigate many aspects of life and the days are so very short, I decided to use my degree to enter business, do my hobby for a living, and do my research for a hobby. I am a Management Information Consultant with Arthur Andersen & Company and work closely enough with computers to make working fun. Due to the dynamic nature of business and life, time alotted to hobbies is in very short supply. My interests therefore tend to be harnessed into cycles.

As a small kid I planted sunflowers, grew lentils, and raised hamsters. As a teenager I became fascinated with electronics and learned how to build gadgets. The last years in school I managed the library and co-edited the student magazine. Then college called for all my attention, but writing the thesis was fun: *Data Processing Support for Emerography;* I bridged two areas which are not commonly put together.

Meanwhile I got used to reading science fiction. Thus, when my job brought me to "the States" and I met Valli Hoski, I did understand what she was talking about. Through Valli I became involved with the GT family. In August 1984 we married.

An intermezzo as Systems Auditor with the First National Bank of Chicago got Ime interested in data protection. I also found time for hydroponics and ham radio. I am holding an "Advanced" amateur radio license; call letters in the USA are KA9WGP.

In August 1987 we moved to Italy for new jobs. This was a major project that required much of our attention. However by now I am ready for more hamming and more research. Current interests include the effective use of a PC for personal administration. Also: history of technology. Furthermore I am trying to read up on classics. Futures pending: maybe music; passive and active. No details yet: "...del doman' non v'é certezza," as Lorenzo rightfully said.



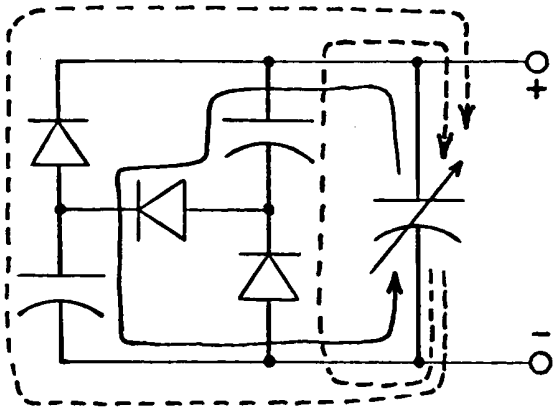
BOOM! General Technics and PFRC launch 55 gallon drums with dynamite at the 1987 Houghton berserker.

Clever Ideas You Should Know About:
A High Voltage Generator
Circa 1963

by Todd Johnson

A few years ago, I ran Across a High voltage generator design that's simple and elegant, but sounds like it must be a something-for-nothing device. In fact, the man who developed it had to show his prototype to the Patent office before they would believe it would work!

This is the basic circuit:

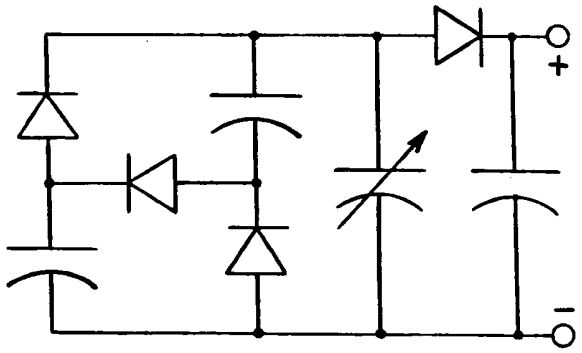


That's it. Just vary the variable cap, and the voltage increases exponentially until something arcs over! It works like this: Assume a small initial charge imbalance caused by thermal or electrostatic effects, or by clipleads and a battery if you want to cheat. As the capacitance goes down, the voltage on the variable cap goes up, so the two fixed caps charge in series (solid arrow) and EACH ends up with the same charge as was delivered by the variable cap. As the capacitance goes back up, the voltage drops and the fixed caps discharge in parallel (dashed arrows) depositing more charge in the variable cap than was taken during the first part of the cycle. So, each cycle raises the voltage more than the previous cycle.
Neat, huh?

The inventor, Dr. Cyril Curtis, was kind enough to lend me the original variable cap used in the prototype. It was perhaps 10" in diameter and had ten sets of four blades like a tuning cap, and was driven by a 3600 RPM fan motor. The diodes were originally vacuum tubes, but 1N4007's work fine. If you want to observe the voltage waveforms, you'll need a 100 MEG high voltage probe because normal scope inputs load things down too much.

If you don't have access to a machine shop, you could use a "butterfly" tuning capacitor which is a balanced version of the familiar tuning cap. I'm told that Lee Hart has used this kind of cap with success. It might be fun to try other kinds of variable capacitor rather than the rotary style. How about mounting two sheets of aluminized mylar close together aluminum side out, and drive it with sound? The only constraint is that the ratio of max to min capacitance must be greater than 2 for the circuit to work, and for maximum power output, the fixed caps should be much larger than the variable.

The large AC component on the output can be reduced by adding another diode and cap:



Several variations are possible. You can make all three caps variable and phase them properly on a common shaft to increase the charge transfer, for instance.
There is a chance that the circuit will not self-start if the initial charge isn't large enough. You can easily start it manually by applying a few volts momentarily when the motor is turned on.

If anyone is really interested in more information. send a SASE and $1.00 and I'll send you a reprint of the paper "Output Power from a Self-Excited Electrostatic Generator" by Cyril Curtis which contains detailed equations and design variations.

As with any high voltage device, BE CAREFUL. The capacitors, depending on their size, could store a lethal amount of energy and deliver it exactly where you don't want it.

Have fun with this thing. Let me know if you come up with any interesting variations or uses for it, and watch this space for further developments!

● ● ● ● ●

ART CREDITS

Cover Photo: The photo that graces our cover is one that Al Duester sent to me months ago, but somehow, when we got down to presstime, I had lost the name of the fellow who took it. I tried to call Al, but he had already left for a trip to Florida and since presstime was the following day, I had to go without it. Sorry Al. Apologies are also extended to to person who took that wonderful picture with the promise that he will be given full credit in the next issue. (MLSJ). Pages 3 through 8 - illos provided by Al Duester, except for the fillo on Page 5, which was done by Bill Higgins. Page 10 - Bill Higgins; Page 11 - Barry Gehm; Page 15 - John Ienniel; Page 16 - Mary Lynn Skirvin Johnson; Page 17 - Bill Higgins; Page 18 - Mary Lynn Skirvin Johnson; Mailing Label Illo - Mary Lynn Skirvin Johnson.

Come on you guys! I KNOW there are more people out there who can draw...or are there??

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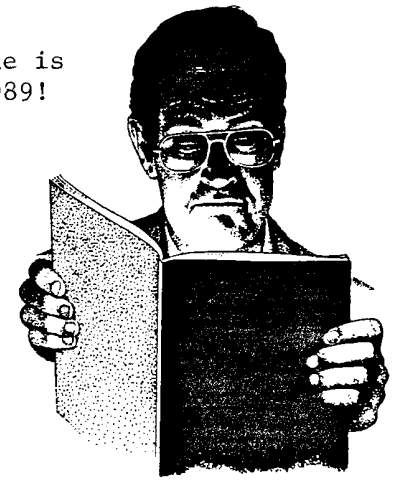
Next deadline is Feb. 5th, 1989!



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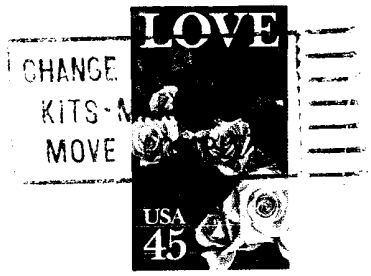

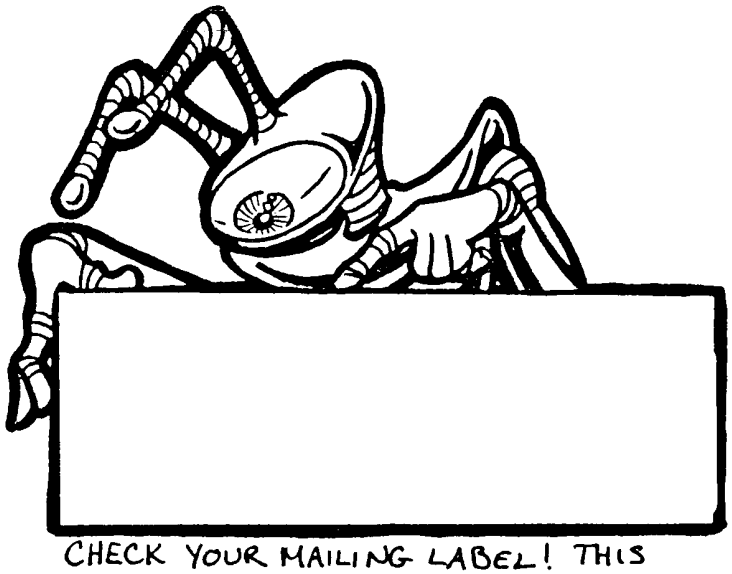

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